

**NJ Science League – February 2007 – Biology 1 exam**

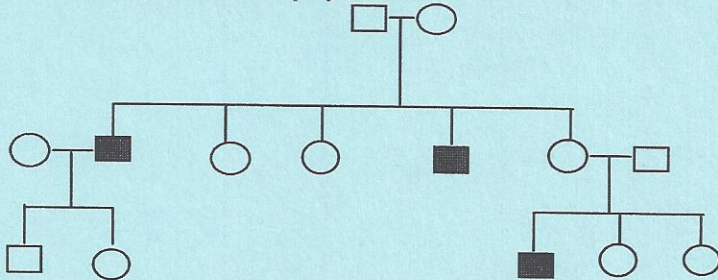
Answer the following questions on the answer sheet provided. Each correct response is worth 14 point. Choose the letter that best completes or answers the item. Be certain that erasures are complete. **Please PRINT your name, school, area, and which test you are taking onto the scan-tron.**

- Where in the human body would you find bacteria used to fight off harmful infections?
  - on your skin
  - in your intestines
  - in your nose and throat
  - on your skin and in your nose and throat
  - on your skin and in your intestines, nose and throat
- What is the importance of Alexander Fleming finding a single mold growing in a used Petri dish?
  - It was the first form of cell mutation
  - It showed that Petri dishes should be sterilized to prevent cross-contamination
  - The mold was found to be toxic
  - It was Penicillin
  - both b and c are correct
- What food has been most closely associated with outbreaks of *E. coli* contamination?
 

a. undercooked beef	d. only a and b are correct
b. non-pasteurized milk and fruit juice	e. a, b and c are correct
c. raw chicken and raw eggs	
- Which of the following contributed to the evolution of drug resistant bacteria?
  - misuse and overuse of prescription antibiotics
  - approximately 50% of all antibiotics end up in animal feed
  - complacency of drug companies to create new antibiotics
  - Only a and c are correct
  - a, b and c were contributing factors
- Which of the following would be considered the least fit in evolutionary terms?
  - a 50-year-old father of three with a terminal disease
  - a 25-year-old father of one
  - a 40-year-old mother of four
  - a healthy 4-year-old
  - a 25-year-old mother of one, who has had a tubal ligation to prevent future pregnancies
- Which of the following groups exhibit the most in common with each other?
 

a. members of the same family	b. members of the same kingdom
c. members of the same genus	d. members of the same phylum
e. members of the same class	
- What does a retrovirus need to integrate its genome into its host's genome?
 

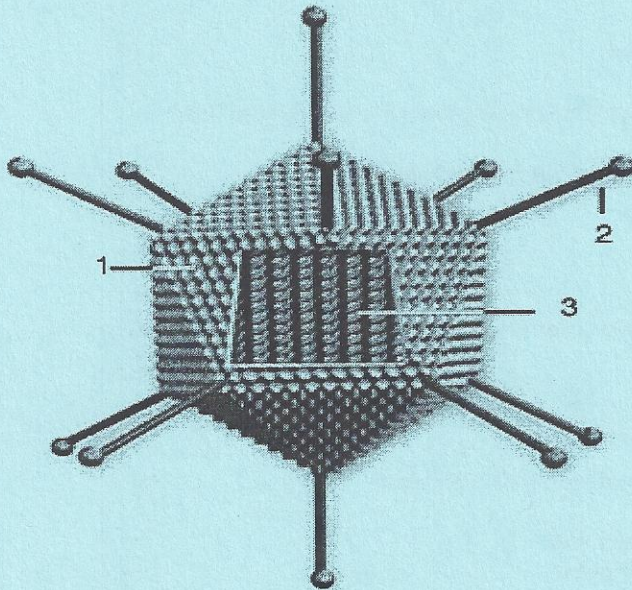
a. DNA dependent DNA polymerase	d. RNA dependent RNA polymerase
b. RNA dependent DNA polymerase	e. host's RNA polymerase
c. DNA dependent RNA polymerase	



- What type of allele caused the disorder that has affected the shaded individuals in the above diagram?
 

a. X-linked recessive	d. autosomal recessive
b. X-linked dominant	e. not enough information is provided to determine the type of allele
c. autosomal dominant	

9. Chemosynthetic bacteria lack photon-absorbing pigments so they derive energy by
- reducing inorganic substances such as ammonia, sulfur, or hydrogen
  - oxidizing inorganic substances such as ammonia, sulfur, or hydrogen
  - oxidizing carbohydrates
  - supplying plants with nitrogen
  - transducing light energy into chemical energy



Use the above diagram to answer questions 10-11

10. #1 points to the

- |                   |           |
|-------------------|-----------|
| a. protein capsid | d. ligand |
| b. capsomer       | e. sheath |
| c. receptor       |           |

11. Which of the following is true about the structure shown in the diagram above?

- |  |  |
|--|--|
| a. It is classified below the cellular level of biological organization. | c. It is visible with a light microscope |
| b. It contains both DNA and RNA  | d. only a and b are true                 |
|  | e. a, b and c are true                   |

Use the following diagram to answer questions 12-13

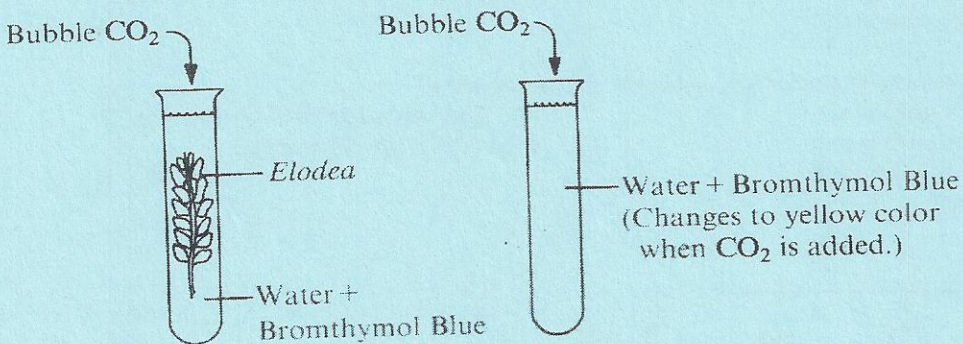


Figure 1 - Experimental

Figure 2 - Control

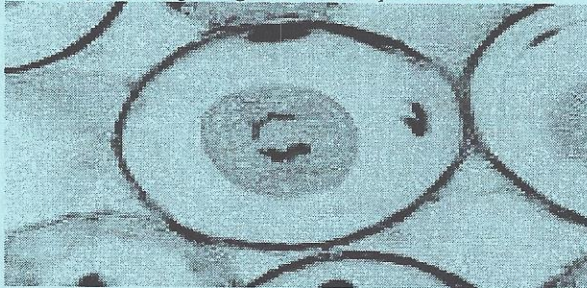
12. What color changes would be observed in the experimental tube during the day and night?
- The solution will be blue during the day and yellow at night.
  - The solution will be blue during the night and yellow during the day.
  - The solution will always be blue.
  - The solution will always be yellow.

13. How does Bromthymol blue act as an indicator?
- Bromthymol blue turns blue in an acid medium and yellow in a basic medium
  - Bromthymol blue turns yellow in an acid medium and blue in a basic medium
  - Bromthymol blue turns yellow in the presence of carbon
  - Bromthymol blue indicates the presence of gas
14. If a thylakoid is damaged so that its interior contents are continuous with those of the stroma, which of the following processes will it most directly impact?
- the reduction of  $\text{NADP}^+$
  - the spitting of water
  - the synthesis of ATP
  - the absorption of light energy by chlorophyll
  - the flow of electrons from photosystem II to photosystem I
15. Of the following, which is associated with both aerobic and anaerobic respiration?
- ATP production
  - Krebs Cycle
  - Oxidative phosphorylation
- I only
  - II only
  - III only
  - I and II only
  - I, II, and III
16. Chordates exhibit all of the following, during some point in their development, except
- a notochord
  - a dorsal hollow nerve cord
  - gill slits
  - postanal tail
  - an exoskeleton

Use the following choices to answer questions 17-19.

- DNA
  - tRNA
  - mRNA
  - rRNA
17. Which of the above choices is translated to synthesize proteins?
18. Which of the above is the primary transcript of eukaryotic genes (transcribed most frequently)?
19. Which of the above is not directly involved in translation?
20. Which of the following is the anticodon on the tRNA that binds the mRNA codon transcribed from a DNA triplet of AAA?
- TTT
  - UUU
  - UUA
  - AAA
  - either UAA or TAA

Use the following image to answer questions 21-22.



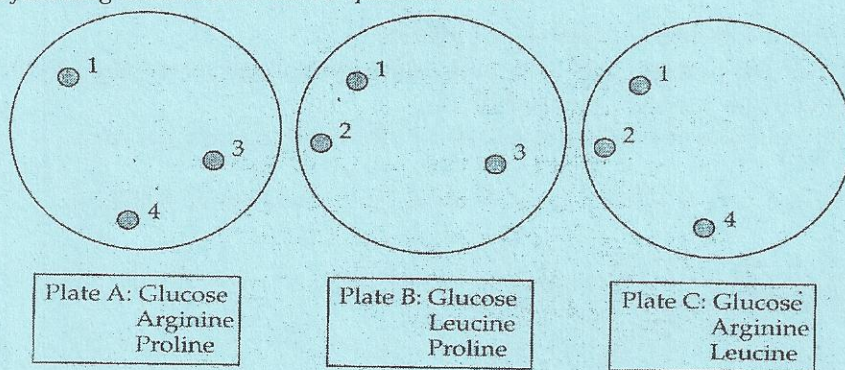
21. Which of the following correctly describes what is occurring in the slide above?
- Thick strands of chromatin are condensing, growing thicker and shorter in the process. Chromosomes cannot yet be seen clearly.
  - Fibers attached to the centromeres shorten as a result of protein molecules being removed from microtubules. At the same time, the overlapping microtubules from each pole join and begin to lengthen as a result of proteins being added to them.
  - The plasma membrane begins to pinch together at the cell's center, as a ring of microfilaments attached to the membrane contracts.
  - Chromosomes move toward the spindle's equator as the microtubules, attached to each centromere, change in length.

22. What is the phase shown in the slide image above?
- a. Prophase    b. Metaphase    c. Anaphase    d. Telophase    e. Interphase
23. All of the following could give rise to new species except
- a. a landslide separating a population of frogs on opposite sides of a lake  
 b. divergent evolution  
 c. evolution of a population of cats that can no longer mate with their ancestors  
 d. variations in antler size between male and female reindeer
24. Which of the following statements is true regarding mammalian evolution?
- a. The first mammals were large predators like the saber-tooth tiger  
 b. The early mammals were most similar to small, bipedal birds  
 c. Mammals evolved from reptilian stocks even earlier than birds  
 d. Mammals were fortunate not to coexist with the dinosaurs.
25. Which of the following is an acceptable definition of evolution?
- a. a change in the environmental conditions  
 b. a change in the phenotypic makeup of a population  
 c. a change in the species composition of a community  
 d. a change in the genetic makeup of a population

Use the following choices to answer questions 26-29

- a. Darwin    b. Linnaeus    c. Lyell    d. la Marck    e. Plato
26. Which of the above scientists published *On the Origin of Species by Means of Natural Selection*?
27. Which of the above scientists wrote mostly about adaptation in his publications?
28. Which of the above scientists is most associated with idealism or essentialism?
29. Which of the above scientists was an advocate of uniformitarianism?

Use the following illustration to answer questions 30-33.

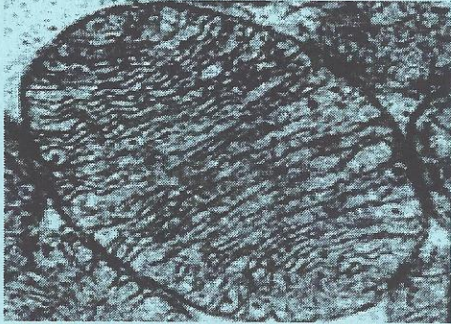


The above illustration shows an experiment involving the growth of several types of bacteria, shown numbered, on agar plates. Glucose was added to each plate as the carbon source and additional amino acids were added to the growth medium in order to satisfy the auxotrophs. Auxotrophs are typically denoted by the type of amino acid required in the medium followed by a minus sign in superscript. If they do not require a particular amino acid, a "+" in superscript is added. Plate A contains glucose, arginine, proline. Plate B contains glucose, leucine, proline. Plate C contains glucose, arginine, leucine.

30. In the above experiment, what is the genotype of Type 3 bacteria?
- a.  $\text{arg}^+, \text{leu}^+, \text{pro}^+$     b.  $\text{arg}^+, \text{leu}^-, \text{pro}^+$     c.  $\text{arg}^+, \text{leu}^+, \text{pro}^-$   
 d.  $\text{arg}^-, \text{leu}^-, \text{pro}^+$     e.  $\text{arg}^-, \text{leu}^-, \text{pro}^-$
31. In the above experiment are Type 1 bacteria auxotrophs?
- a. Yes, they are able to grow in the presence of the three amino acids being tested  
 b. Yes, they can only grow if glucose is present  
 c. No, they are able to grow in the absence of glucose  
 d. No, they are able to grow in the absence of any additional amino acids  
 e. Additional information is needed to answer this question

32. Using an electron microscope, if we observed cells from Type 1 bacteria, what structures would we be able to see?
- nuclei
  - ribosomes
  - mitochondria
  - a, b, and c are correct
  - none of the above
33. If a fourth Petri dish was made with a growth medium that included glucose, arginine and proline and it was inoculated with colony 2, would bacterial growth be observed?
- No, Type 2 is a leucine auxotroph
  - No, Type 2 cannot grow in the presence of arginine
  - Yes, Type 2's genotype is  $arg^-$ ,  $pro^-$
  - Yes, Type 2 only requires glucose to grow
  - Not enough information is given to answer this question

Use the following illustration to answer questions 34-35.



34. What does the above organelle have in common with a chloroplast?
- DNA is Present
  - ATP is produced
  - Ribosomes are present
  - Only a and b are correct
  - a, b and c are correct
35. The primary function of the above organelle is the production of ATP. To carry out this function, it must have all of the following except
- enzymes for glycolysis
  - enzymes for the Krebs cycle
  - ATP synthase
  - the membrane-bound electron transport chain
  - proton pumps embedded in the inner membrane
36. What metabolic pathway is common to both fermentation and cell respiration?
- the Krebs cycle
  - Glycolysis
  - the electron transport chain
  - reduction of pyruvate to lactate
  - synthesis of acetyl CoA from pyruvate
37. How might you explain the genetic basis of a disorder that occurs with equal frequency among both sexes and the does not follow basic patterns of Mendelian inheritance?
- multiple genes may be responsible for the disease
  - the development of the disease may depend in part on the presence of other genes
  - It occurs from nondisjunction of the sex chromosomes
  - It is due to an autosomal gene
  - Both a and b are possible
38. Hemophilia is due to a recessive allele on the X chromosome. What is the probable ratio of offspring from a cross between parents who have normal clotting, but the mother is a carrier.
- 1 normal daughter : 1 carrier daughter : 1 normal son : 1 hemophiliac son
  - 2 carrier daughters : 1 normal son : 1 hemophiliac son
  - 2 normal daughters : 1 normal son : 1 carrier son
  - 1 normal daughter : 1 carrier daughter : 1 normal son : 1 carrier son
  - 1 normal daughter : 1 carrier daughter : 1 carrier son : 1 hemophiliac son

39. In the case described in number 38 above, why are female hemophiliacs rare?
- They die when they are born
  - Hemophilia cannot be expressed in females
  - Both parents must have the allele
  - All of the above
40. In preparing a karyotype, in what stage of mitosis are chromosomes photographed?
- prophase
  - metaphase
  - anaphase
  - telophase
  - interphase
41. A new species of terrestrial animal with an exoskeleton, tracheal system, and modified segmentation was found. Which of the following would most likely also be found on the organism?
- parapodia
  - wings
  - eight legs
  - a water vascular system
  - a sessile life style
42. What do arthropods and fungi have in common?
- The haploid state is dominant in both groups
  - Both groups are predominantly saprophytic in nutrition
  - Both groups use chitin for the construction of protective coats
  - Both groups have cell walls
43. In flowering plants, meiosis occurs specifically in which of the following?
- endosperm
  - megaspore mother cells
  - microspore mother cells
  - a, b, and c are correct
  - only b and c are correct
44. A female fruit fly bearing linked genes that produce the phenotype gray body and normal wings mates with a male fruit fly of phenotype black body and vestigial wings. The appearance of black-bodied flies with normal wings among the progeny is best explained by
- crossing over
  - independent assortment
  - segregation of alleles
  - penetrance
  - dominance
45. A nucleotide may contain
- ribosomes
  - nucleic acid molecules
  - AMP
  - ATP
  - ADP
46. During which phase of the cell cycle is DNA replicated?
- prophase
  - metaphase
  - anaphase
  - telophase
  - interphase
47. Which of the following is NOT true of HIV, the virus that causes AIDS?
- it is a retrovirus
  - it is a DNA virus
  - it incorporates viral DNA into the host cell's genome
  - it attacks helper T cells
48. During which of the following stages of cell respiration is ATP produced by substrate level phosphorylation?
- glycolysis
  - Krebs cycle
  - Calvin cycle
  - both a and b are correct
  - both a and c are correct
49. How many different gametes can be produced based on the genotype AaBbCc?
- 6
  - 8
  - 10
  - 12
  - 14
50. During photosynthesis, free oxygen is released from
- carbohydrates
  - carbon dioxide
  - water
  - chlorophyll
  - NADH
51. Which of the following is reduced in the Krebs cycle?
- oxygen
  - water
  - NAD<sup>+</sup>
  - Pyruvate
  - glucose
52. Which structure is believed to have evolved from an independently living prokaryote?
- nucleus
  - ribosome
  - vacuole
  - chloroplast
  - lysosome

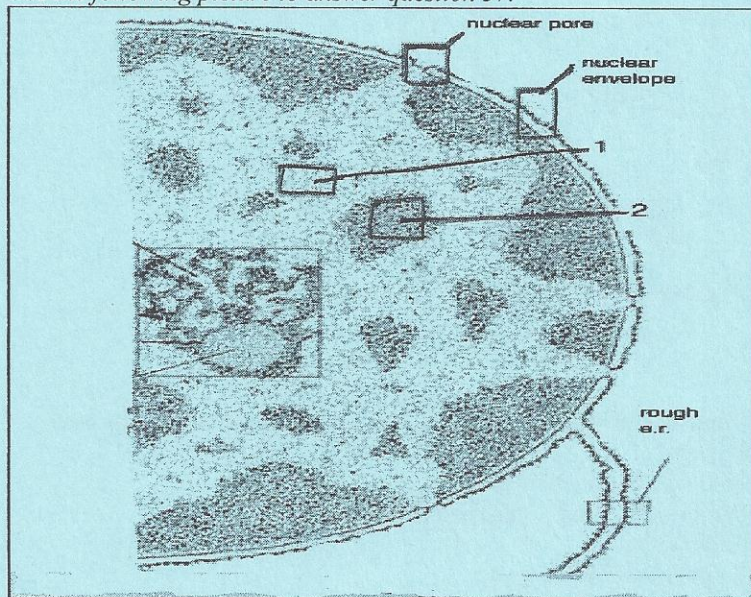
53. The evolutionary history of a species is its  
 a. ontogeny      b. taxonomy      c. phylogeny      d. biology
54. Which of the following is a characteristic of cells that have mutated into cancer cells compared to normal, healthy cells?  
 a. shorter life cycle      b. regulated rates of cell division      c. lower rates of mitosis  
 d. higher rates of translation      e. identical DNA

Refer to the table below to answer questions 55-56

	U	C	A	G	
<b>U</b>	Phe	Ser	Tyr	Cys	<b>U</b>
	Phe	Ser	Tyr	Cys	<b>C</b>
	Leu	Ser	STOP	STOP	<b>A</b>
	Leu	Ser	STOP	Trp	<b>G</b>
<b>C</b>	Leu	Pro	His	Arg	<b>U</b>
	Leu	Pro	His	Arg	<b>C</b>
	Leu	Pro	Gln	Arg	<b>A</b>
	Leu	Pro	Gln	Arg	<b>G</b>
<b>A</b>	Ile	Thr	Asn	Ser	<b>U</b>
	Ile	Thr	Asn	Ser	<b>C</b>
	Ile	Thr	Lys	Arg	<b>A</b>
	Met	Thr	Lys	Arg	<b>G</b>
<b>G</b>	Val	Ala	Asp	Gly	<b>U</b>
	Val	Ala	Asp	Gly	<b>C</b>
	Val	Ala	Glu	Gly	<b>A</b>
	Val	Ala	Glu	Gly	<b>G</b>

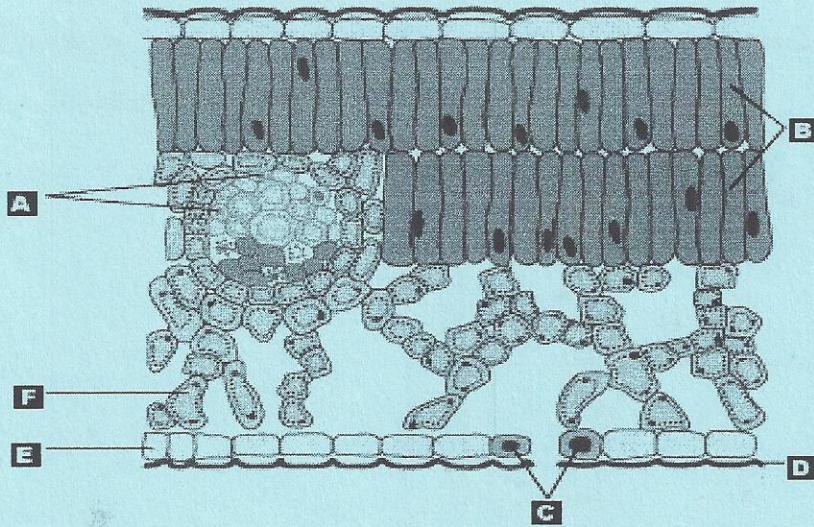
55. All of the codons that represent Valine begin with  
 a. guanine      b. uracil      c. cytosine      d. methionine
56. Which of the following could be a 5'→3' nucleotide sequences in a DNA template strand for an mRNA coding for the polypeptide sequence Phe-Pro-Lys?  
 a. UUU-CCC-AAA      b. AAA-GGG-UUU      c. CTT-CGG-GAA  
 d. AAA-CCC-UUU      e. GAA-CCC-CTT

Use the following picture to answer question 57.



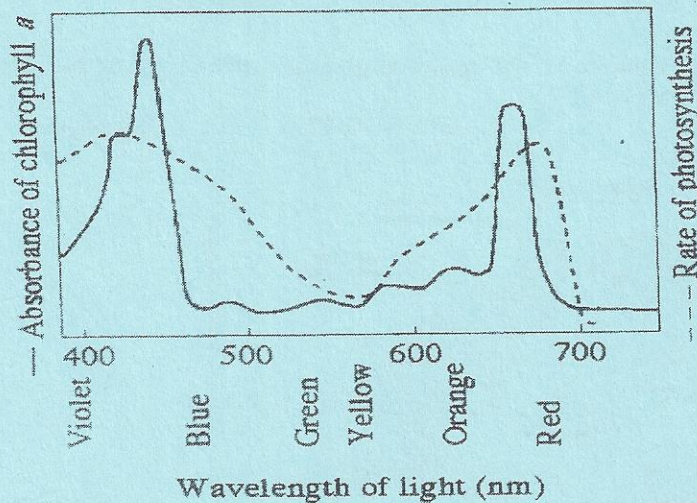
57. #2 points to  
 a. euchromatin.      b. heterochromatin      c. an area composed of unique RNA sequences  
 d. a region rich in microtubules      e. a single condensed chromosome

Use the following diagram to answer question 58.



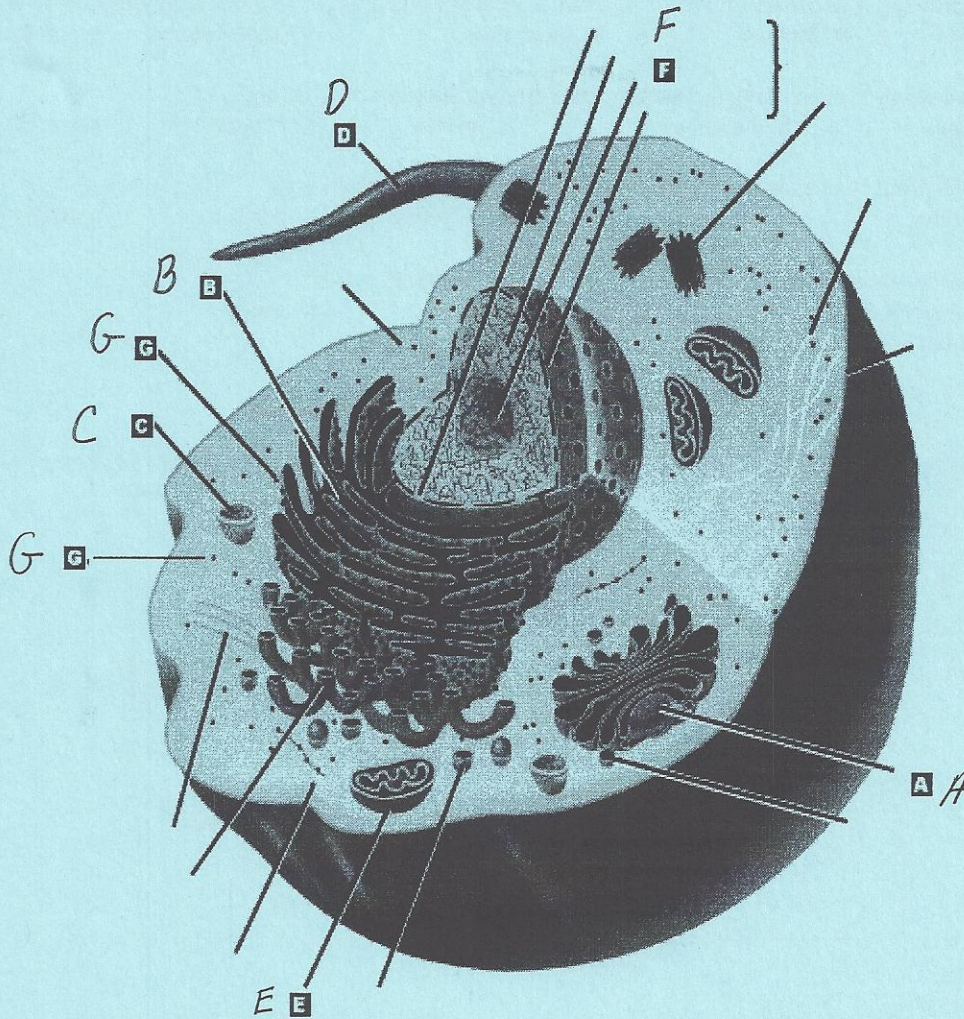
58. Which of the following are photosynthetic?
- a. A only
  - b. B only
  - c. F only
  - d. A through F are all photosynthetic
  - e. B and F are photosynthetic

Use the following graph to answer question 59.



59. The above graph shows the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis. Which of the following explain why they are different?
- a. Anaerobic bacteria may have interfered with the light absorption
  - b. Yellow and green wavelengths inhibit the absorption of blue and red wavelengths
  - c. Other pigments absorb light besides chlorophyll *a*
  - d. Sunlight that is too bright can destroy photosynthetic pigment
  - e. An error must have occurred in this experiment



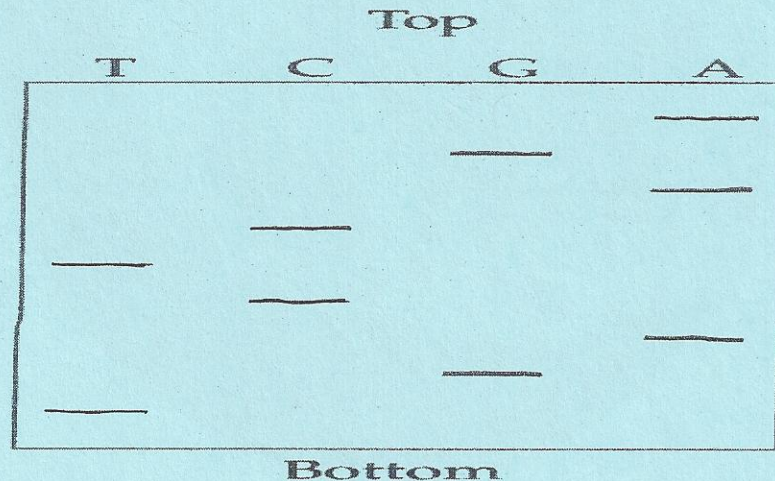


Use the above picture for questions # 60 –63.

60. Proteins that may be exported from this cell are made at the  
 a. A            b. B            c. C            d. E            e. F
61. Which structure contains grana, thylakoids and stroma?  
 a. A            b. B            c. C            d. E            e. none of these
62. Which of the following is present in a prokaryotic cell?  
 a. B            b. E            c. F            d. G            e. none of the above
63. Where does translation occur?  
 a. A            b. B            c. C            d. E            e. F
64. How many oxygen molecules are required to completely oxidize a molecule of glucose during aerobic respiration?  
 a. 1            b. 2            c. 6            d. 12            e. 36
65. Which statement below supports the belief that glycolysis is one of the most ancient of metabolic processes?  
 a. It neither uses nor requires oxygen.  
 b. It occurs in all eukaryotic cells.  
 c. If run in reverse, glycolysis will build glucose molecules.  
 d. Bacteria utilize glycolysis
66. All of the following substances are produced in a muscle cell under anaerobic conditions except  
 a. ATP            b. NADH            c. pyruvate            d. lactate            e. acetyl CoA

67. Which of the following refers to an organism with radial cleavage and a blastopore that develops into an anus?  
 a. bryophyte    b. pterophyte    c. monostome    d. deuterostome    e. protostome
68. Which of the following is most likely the most recent common ancestor of all animals?  
 a. prokaryote    b. bacterium    c. protist    d. fungus    e. plant
69. Which of the following is an animal with no muscle tissue and is not diploblastic?  
 a. roundworm    b. flatworm    c. jellyfish    d. comb jelly    e. sponge
70. Which of the following is most likely the reason why insects are so successful?  
 a. jointed appendages    b. chewing mandibles    c. wings  
 d. internal fertilization    e. number of appendages

The following diagram shows a cloned DNA fragment that has been sequenced. Use it to answer questions 71-72.



71. Which of the following is the correct nucleotide sequence that corresponds to the pattern above?  
 a. 3'TGACTCAGA5'    b. 5'AGACTCAGT3'    c. 3'TTCCGGAAA5'  
 d. 5'TGACTCAGA3'    e. none of the above
72. Which of the following is probably the process that yielded the above results?  
 a. centrifuge    b. bioassay    c. electrophoresis    d. distillation    e. vivisection
73. Which of the following scientists devised a taxonomic system that used anatomical features as the basis for classifying organisms?  
 a. Darwin    b. Lamarck    c. Lyell    d. Linnaeus    e. Wallace
74. What was the predominant belief before the time of Lyell and Darwin?  
 a. The Earth is millions of years old and populations gradually change over time.  
 b. The Earth is millions of years old and populations are unchanging over time.  
 c. The Earth is millions of years old and populations rapidly change over time.  
 d. The Earth is 6,000 years old and populations are unchanging over time.  
 e. The Earth is 6,000 years old and populations gradually change over time.

Use the following events to answer question 75.

1. origin of mitochondria
2. origin of multicellular eukaryotes
3. origin of chloroplast
4. origin of cyanobacteria
5. origin of fungal/plant symbioses

75. The above are events in the evolution of life on Earth. Put them in the correct order from earliest to most recent.

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

76. Evolutionary trends, such as reduced surface area among arctic animals, provide evidence that

- a. an unseen guiding force is at work
- b. a larger volume-to-surface ratio is beneficial to all mammals
- c. evolution progresses toward a predetermined goal
- d. in particular environments, similar adaptations can be beneficial in more than one species
- e. evolution always tends toward increased complexity or increased size

77. Which of the following is found with all viruses?

- a. glycoprotein cell wall
- b. a protein capsid
- c. nucleic acid genome
- d. a and b only
- e. b and c only

78. Which of the following describes a virus that has a single strand of RNA that acts as a template for DNA synthesis?

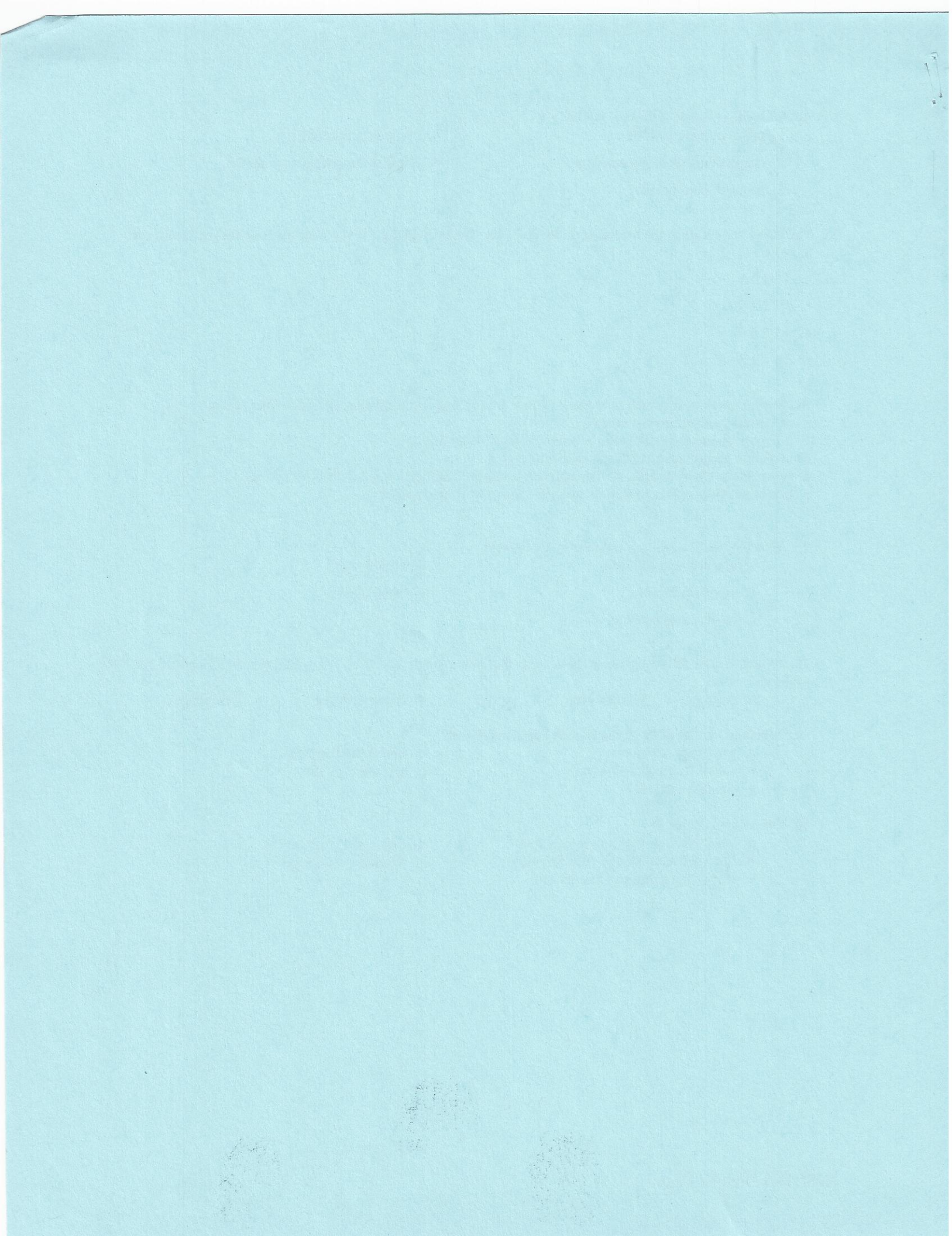
- a. provirus
- b. retrovirus
- c. viroids
- d. bacteriophages
- e. lytic phages

79. Which is/are true of HPV, the Human Papilloma Virus?

- a. can be spread by sex
- b. causes irregular cell growth
- c. can cause cancer
- d. only a and b are true
- e. a, b and c are true

80. Viruses are capable of

- a. changing their structure by mutation
- b. lying dormant in body cells for years
- c. employing a disguise mechanism
- d. only a and b are correct
- e. a, b and c are correct



**New Jersey Science League  
Biology I Answer Key  
Date: February, 2007**

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

**BIOLOGY I TOPICS OF STUDY 2007 SEASON**

**January** - cell structure, metabolism, enzymes, experiments, inorganic/organic compounds, photosynthesis, respiration, philosophy/history, structure of matter, diffusion, energy, ATP/P, measurement, pH, microscope.

**February** - classification, mitosis/meiosis, genetics, DNA/RNA, evolution, virus, experiments, cell structure, philosophy/history, photosynthesis, anaerobic/aerobic respiration, bacteria.

**March** - animal structure/function/systems, plant structure/function/systems, cycles, evolution, embryology, reproduction, history/philosophy, experiments, fungi, algae, ecology, disease, mitosis/meiosis.

**April** - human anatomy & physiology, nutrition, enzymes, embryology, populations, animal/plant behavior, ecology, cycles, regulation/homeostasis, disease, experiments, philosophy/history.

**TESTING DATES FOR THE NEW JERSEY SCIENCE LEAGUE**

**TESTING DATES FOR THE NEW JERSEY SCIENCE LEAGUE**

**Thursday, January 11, 2007      Thursday, February 8, 2007**

**\*Thursday, March 15, 2007\*\*Thursday, April 12, 2007\***

The March and April exam dates may encounter HSPA and spring break scheduling conflicts. Each area may change to an agreed date for all schools in their area to take the exams. April exams must be completed by April 30<sup>th</sup>. Also, no exams during the first week of April.

