

January 15, 2015

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.

- A cell can live in a healthy condition without performing which of the following functions?
  - anabolism
  - active transport
  - catabolism
  - mitosis
- Oxygen and carbon dioxide are exchanged in the lungs by
  - active transport
  - diffusion
  - filtration
  - osmosis
- What is the most important outcome of cellular respiration?
  - carbon dioxide discharge
  - oxygen intake
  - energy release from food
  - food intake
- At average room temperature and low humidity, heat is lost from the body
  - mainly by conduction
  - mainly by evaporation and conduction
  - mainly by evaporation and radiation
  - only by evaporation
- Larger than normal amounts of acetoacetic acid enters the blood as a direct result of insulin deficiency. Acetoacetic acid is buffered in the blood chiefly by
  - carbon dioxide
  - sodium bicarbonate
  - sodium chloride
  - Potassium salt of hemoglobin
- Which of the following cell parts are common to both plant and animal cells?
 

I. cell wall    II Centrioles    III Ribosomes

  - I only
  - I and II only
  - II and III only
  - III
- Based on the chart below, a unit of malt sugar could be made similar to a basic unit of corn syrup through the process of
 

<i>Sugar Name</i>	<i>Carbohydrate</i>	<i>Basic Unit</i>
Brown Sugar	Sucrose	Disaccharide
Corn syrup	Glucose	Monosaccharide
High Fructose Corn Syrup	Fructose	Monosaccharide
Malt sugar	Maltose	Disaccharide
Milk Sugar	Lactose	Disaccharide

  - condensation
  - hydrolysis
  - dehydration synthesis
  - hydrogen bonding
- Which cell is most likely to have the greatest number of mitochondria?
  - adipose cell
  - epidermal cell
  - hair cell
  - cardiac muscle cell
- The digestive enzyme secretin stimulates the pancreas to produce bicarbonate ( $\text{HCO}_3^{-1}$ ), which is released into the small intestine. What might be a reason for this series of events?
  - Pancreatic bicarbonate helps to regulate the pH of the blood stream.
  - Pancreatic bicarbonate helps to neutralize stomach acid that enters the small intestine.
  - Pancreatic bicarbonate is a waste product of protein digestion.
  - Pancreatic bicarbonate helps to increase the acidity of the small intestine to aid in digestion.
- Which is a plausible explanation for the fact that peptide hormones have a faster onset of action than steroid hormones?

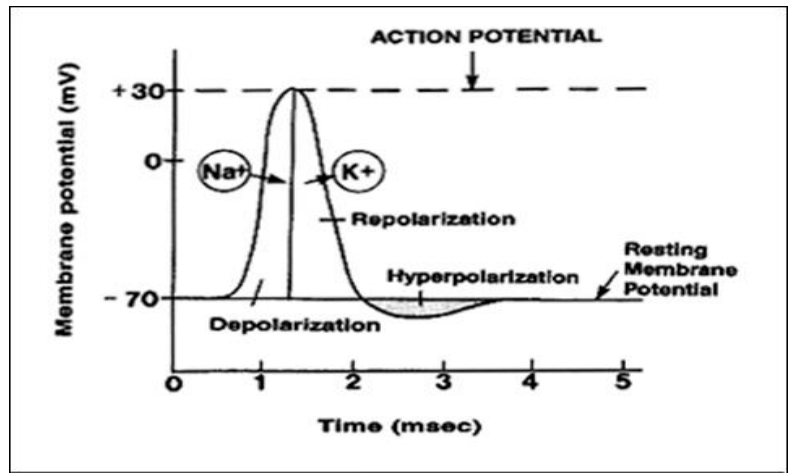
- a. Peptide hormones can diffuse across the membrane of a target cell and steroid hormones cannot.
- b. Steroid hormones bind to extracellular receptors, and these receptors take several hours to respond.
- c. Peptide hormones bind to extracellular receptors to producing immediate effects, while steroid hormones bind to DNA affecting transcription.
- d. Both hormones bind to DNA and affect transcription but peptides enter the nuclear membrane faster.

11. If  $C^{14}O_2$  (contains radioactive carbon) is used in photosynthesis, in what substance would the radioactivity most likely appear?

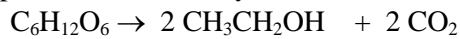
- a. Chlorophyll
- b. ATP
- c. Carbohydrates
- d. NADPH

12. When a neuron's membrane potential is between -70 and -90 millivolts (graph to the right), the cell is experiencing

- a. depolarization
- b. repolarization
- c. hyperpolarization
- d. threshold



13. What is the process illustrated by the chemical reaction below?



- a. esterfication
- b. methanol fermentation
- c. ethanol fermentation
- d. lactic acid fermentation

14. Healthy pregnant mammals produce isomerase enzyme to make galactose during milk production. Isomerase deficiency means that...

- a. glucose cannot be converted to galactose
- b. galactose cannot be converted into lactose
- c. galactose cannot pass across the membranes in the mammary glands
- d. galactose is not an isomer of glucose

15. Cellular respiration involves a negative  $\Delta G$  equal to -686 kilocalories which indicates the reactions are

- a. endergonic
- b. exergonic
- c. at equilibrium
- d. enzyme controlled

16. A disease that destroys the cytoskeleton will most likely interfere with

- a. DNA transcription
- b. glycolysis
- c. mitotic divisions
- d. active transport system

17. An enzyme-controlled reaction could overcome competitive inhibition, if the scientist

- a. adds buffers
- b. increases substrate concentration
- c. elevates the pH
- d. decrease the temperature

18. Studies indicate acid reflux from the stomach, may cause esophageal cancer. An oncologist thinks that a lack of cell to cell recognition is a contributing factor to this cancer. The research oncologist will focus the studies on

- a. destruction of oligosaccharides on the e-face of the cell membranes in the esophagus
- b. loss of an electrochemical gradient for ion transport in the cells of the stomach
- c. homeostasis of membrane fluidity in all cells
- d. detached cytoskeleton from cell membranes

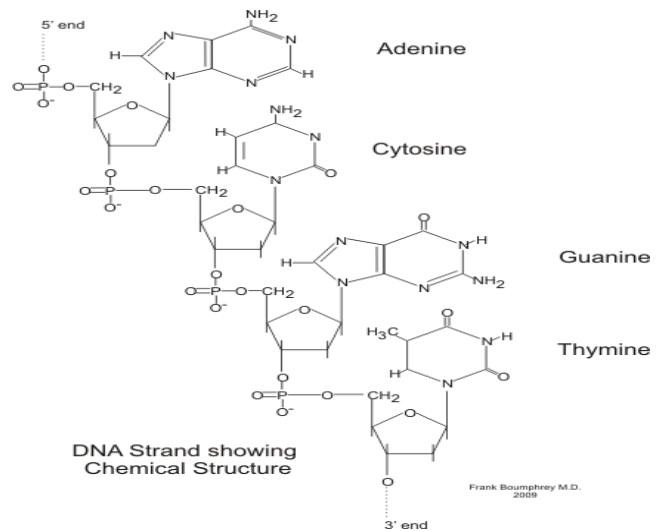
19. A microbiologist examined two groups of cells and made the observations listed in the table below. What conclusion is supported by these observations?

Trait	Cell I	Cell II
Cell wall	+	+
Ribosomes	+	+
Nucleus	-	+
Ability to photosynthesize	+	-
Cell respiration	+	+

- a. Cell I is more complex than Cell II.
  - b. Cell II is an ancestor to Cell I.
  - c. Cell I is a prokaryote.
  - d. Both groups are from different parts of a plant.
20. Where would a biochemist be least likely to find a transmembrane protein?
- a. cell membrane
  - b. nucleus
  - c. chloroplast
  - d. ribosome
21. Normal adult human hemoglobin is comprised of 2 alpha and 2 beta polypeptides. Therefore, hemoglobin exhibits \_\_\_\_\_ level of organization?
- a. primary
  - b. secondary
  - c. tertiary
  - d. quaternary
22. Beta amylase is an enzyme that breaks down polysaccharides into its components, but is not produced by humans. Beta amylase is most effective in digesting
- a. glycogen
  - b. glucose
  - c. cellulose
  - d. starch
23. Cholesterol is soluble in organic solvents such as chloroform, but insoluble in water. Based on the information, to which class of macromolecules does cholesterol belong?
- a. enzyme
  - b. oligosaccharide
  - c. nucleic acid
  - d. lipid
24. Pharmaceutical researchers are often interested in blocking particular receptor proteins on cell surfaces. What chemical property of a molecule would be most important for binding to a receptor's active site?
- a. The type of bonding
  - b. The amount of ATP available
  - c. The number of double bonds in the formula
  - d. The molecule's molecular shape
25. Peptide neurohormones are primarily synthesized in which cellular structure?
- a. rough endoplasmic reticulum
  - b. smooth endoplasmic reticulum
  - c. cytoplasmic polyribosomes
  - d. nucleus
26. Predict what would happen to a group of lipid molecules when they are added to a polar solvent.
- a. The lipids would precipitate out.
  - b. The lipids would group together
  - c. A chemical reaction would occur between the lipid and solvent
  - d. There is no way to predict what would happen.

27. In the diagram, a phosphodiester bond forms between which two molecules?

- A phosphate and the 3' carbon on the pentose sugar
- A phosphate and the 1' carbon on the pentose sugar
- A phosphate and the nitrogen
- A 5' carbon on the pentose sugar and the nitrogen base

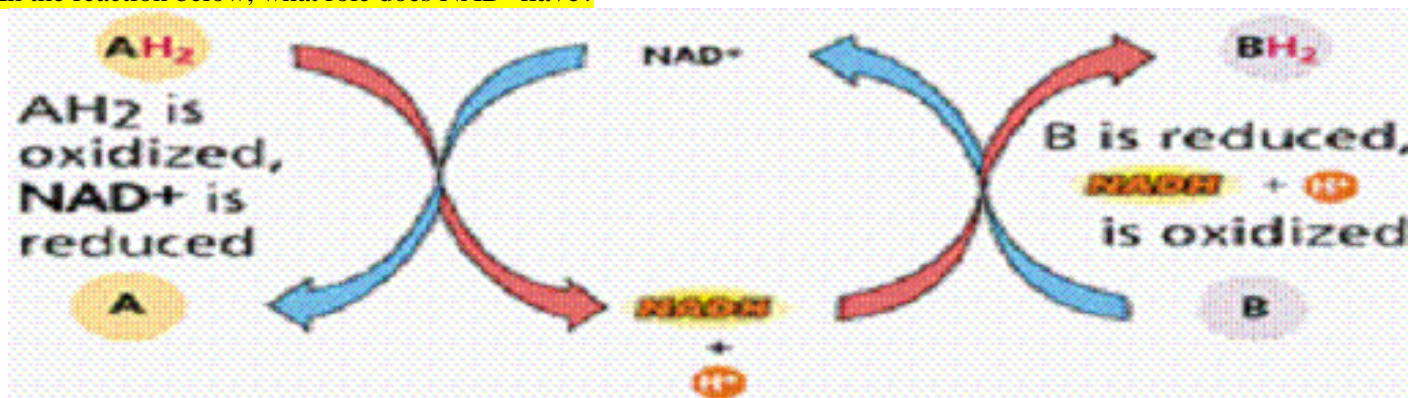


28. The hypothesis that chloroplasts and mitochondria were originally prokaryotic organisms living within eukaryotic hosts is supported by the fact that mitochondria and chloroplasts

- possess circular DNA
- possess capability for protein synthesis
- possess a bilipid layer membrane
- possess characteristic ribosomes of prokaryotes

- I and IV only
- I and III only
- I and II and III
- I, II, III, and IV only

29. In the reaction below, what role does  $\text{NAD}^+$  have?



- An intermediary energy carrier compound
- Reduces the energy needed for the reaction to occur
- Acts an enzyme for form AB
- Evenly distributes all hydrogens

30. Which of the following enhances membrane fluidity?

- Unsaturated hydrocarbons of the phospholipid tails
- Peripheral membrane proteins
- Saturated hydrocarbon of the phospholipid tails
- Integral membrane proteins

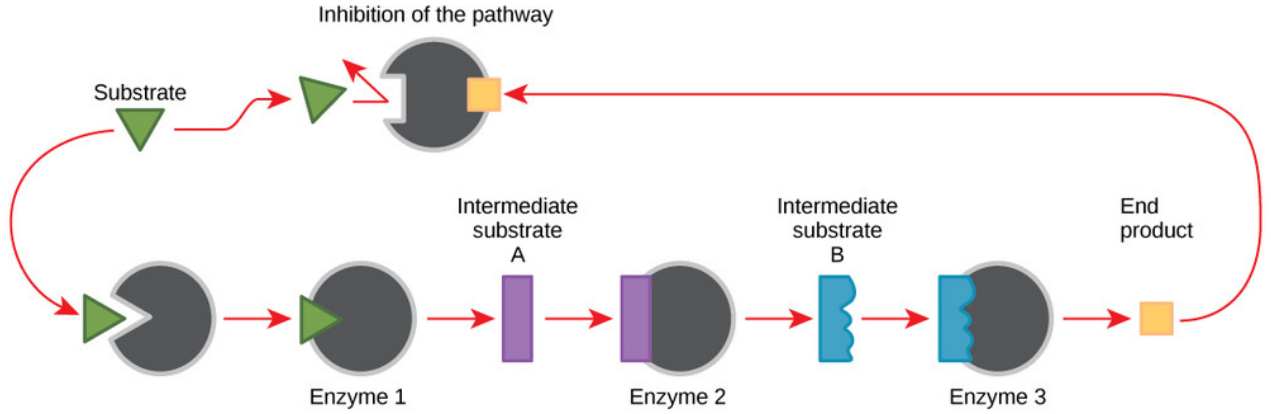
31. A research oncologist discovers the addition of a new hydrophobic drug to a culture of cancer cells results in increased transcription of a specific gene. Which type of receptor is most likely activated?

- an ion-linked channel
- an intracellular receptor
- an enzyme linked receptor
- a G-protein linked receptor

32. A solution in a beaker contains all the enzymes necessary for undergoing glycolysis. A mole of glucose is mixed into a solution. No oxygen or ATP is present. Does glycolysis occur? Why or why not?
- Yes, because oxygen is not present
  - No, because ATP is not present
  - Yes, because glycolysis is not ATP dependent
  - Yes, because glycolysis is anaerobic
33. DNP (Dinitrophenol) is a uncoupling agent which inhibits a membrane's ability to maintain a proton gradient. How does this DNP affect the function of the mitochondria?
- Increase ATP production
  - Decrease ATP production
  - No change in ATP production
  - Increase in  $FADH_2$
34. Five mice were fed a diet containing a radioactive marker for oxygen in glucose. After the mice metabolized the glucose, where would the radioactive oxygen be found?
- $H_2O$
  - $CO_2$
  - $O_2$
  - ATP
35. If cellular respiration were 100% efficient the process would produce approximately 80 ATP. However, the actual yield is around 30 ATP. What happens to the rest of the chemical energy in glucose?
- It is converted to starch
  - It stored as fat
  - It is converted to heat
  - It is released as  $CO_2$  and  $H_2O$
36. The calcium concentration in a cell is 0.3%. The concentration of calcium in the surrounding fluid is 0.1%. How does the cell maintain a higher concentration of calcium than its environment?
- passive transport
  - active transport
  - osmosis
  - diffusion
37. Which of the following correctly ranks the following structures in terms of size, largest to smallest?  
Chloroplast =C    Mesophyll cell =MC    Photosystem =P    Chlorophyll molecule=M  
Thylakoid = T
- P, T, M, C, MC
  - MC, C, M, T, P
  - MC, C, T, P, M
  - T, MC, C, P, M
38. When light strikes chlorophyll molecules they lose electrons, which
- split water
  - breaks down ATP
  - oxidize glucose
  - fix carbon
39. As the filtrate passes through the loop of Henle, salt is removed and the concentration of salt in the interstitial tissue of the kidney medulla rises. Because of the high salt concentration, the nephron is able to:
- control the pH of the interstitial fluid
  - reabsorb water most efficiently
  - excrete large amount of water
  - excrete maximum amount of salt
40. The histological section of a foot of a 15-day-old mouse embryo shown below, visualized using light microscopy, reveals areas of tissue between the toes is being eliminated before the mouse reaches its full gestational age at 27 days. In this embryo, what process is occurring?
- Necrosis
  - Apoptosis
  - Regeneration
  - Degeneration



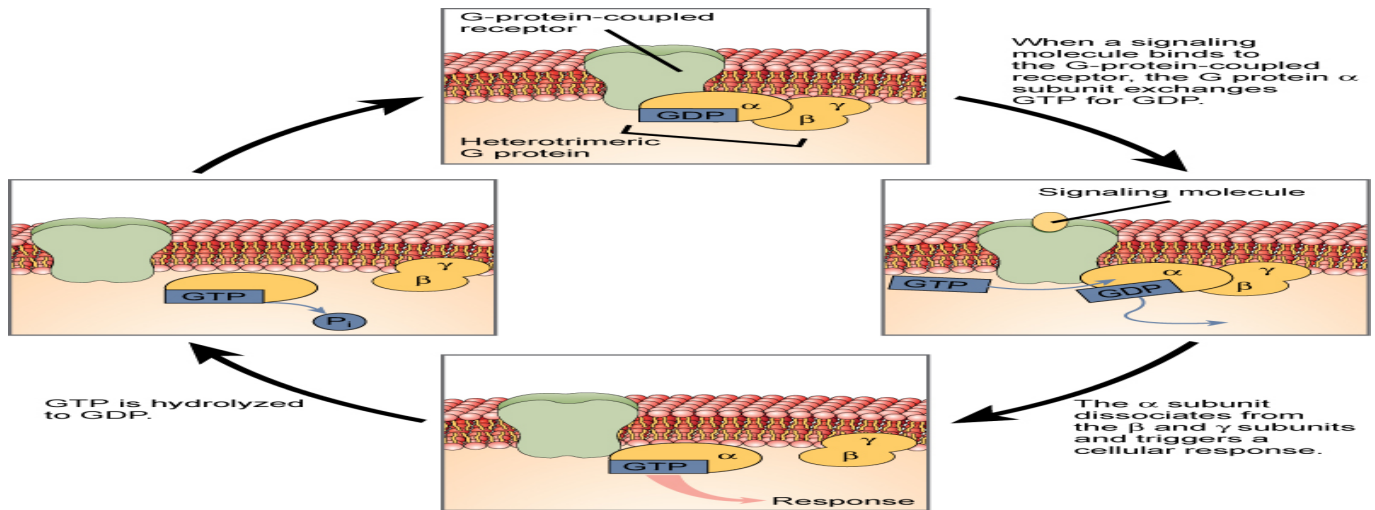
41. In this diagram, the product becomes the



- a. Allosteric Inhibitor
- b. Competitive Inhibitor
- c. Secondary Substrate
- d. Enzyme-substrate Complex

42. Using the diagram below, determine what action terminates the signal?

- a. Binding G-protein to the membrane
- b. A cellular response
- c.  $\beta$  and  $\gamma$  subunits dissociate
- d. Hydrolysis of GTP to GDP



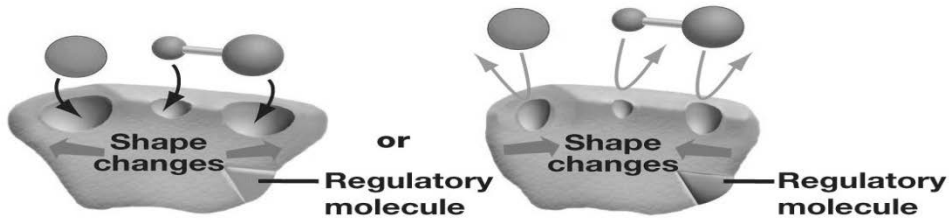
43. A colony of bacteria begins to increase the production of a toxin when a few bacteria detect competing bacteria within their environment. This is an example of

- a. Cell adhesion
- b. Cell diffusion
- c. Cell communication
- d. Cell stimulation

44. Adfarm researchers discover a new human protein that functions in the production of the nuclear envelope. Bioinformatic analysis indicates that *Saccharomyces cerevisiae* has a homologous protein. What would their next thought be?

- a. The scientist cannot use their present data because it does not relate directly to humans
- b. The scientist cannot correlate the bioinformatic analysis to human data.
- c. The scientist can study the function of the protein using *S. cerevisiae* as a model
- d. The scientist can assume all eukaryotics use the protein

45. The diagram below illustrates which kind of enzyme interaction?

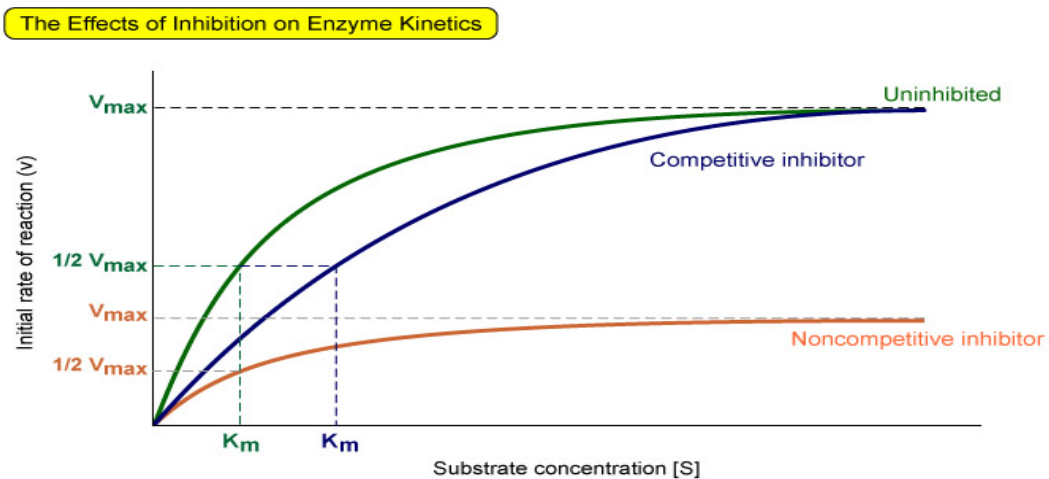


The active site becomes available to the substrates when a regulatory molecule binds to a different site on the enzyme.

The active site becomes unavailable to the substrates when a regulatory molecule binds to a different site on the enzyme.

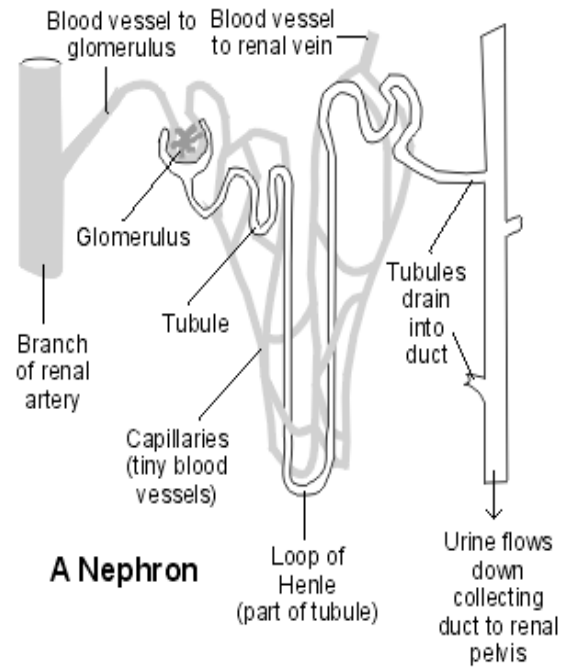
- a. Competitive inhibition      b. Allosteric regulation      c. Noncompetitive inhibition      d. Feedback inhibition

46. Competitive and noncompetitive inhibition affects the rate of reaction differently. What conclusion does the graph below support?



- a. Competitive inhibitors do not affect the initial rate of reaction, whereas noncompetitive inhibitors do.  
 b. Competitive inhibitors affect the maximal reaction rate, whereas noncompetitive inhibitors do not affect the maximal rate.  
 c. Competitive inhibitors affect the initial rate, but do not affect the maximal rate, whereas noncompetitive inhibitors affect the maximal rate.  
 d. The data do not support the original statement.

47. Marine bony fishes have solved the problem of living in a too salty environment. They do lose water continuously but replace it by drinking sea water and then desalting it. The salt is returned to the sea by active transport in their gills. Living in constant danger of dehydration by the hypertonic sea, there is no reason to pump out large amounts of nephric filtrate. Therefore, less water placed in the tubules, the less that has to be reabsorbed. Marine bony fishes rely more on tubular secretion for eliminating excess or waste solutes. They have a renal portal vein to the tubules of the kidney. If one were to contrast a human nephron (shown below) with a nephron from a marine bony fish, what structure in the fish nephron might be missing or reduced in size?

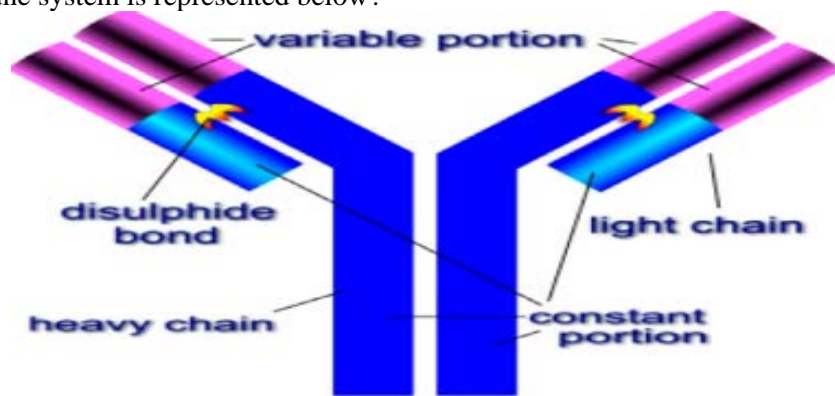


- a. collecting Tube
- b. glomerulus
- c. Loop of Henle
- d. blood vessels

48. In a typical eukaryotic cell the surface area-to-volume ratios of the endoplasmic reticulum relative to the cytosol volume, the inner membrane of the mitochondria relative to the matrix volume, and the thylakoid membranes relative to the stromal volume in the chloroplast are all high. This implies that \_\_\_\_.

- a. the enclosed compartments in these organelles has a large volume
- b. these organelles are very metabolically active and need high exchange surface areas to support their activities.
- c. the membranes are necessary to keep their compartments distinct from the surrounding environment.
- d. the surface area is not relative to the volume in these organelles and their function.

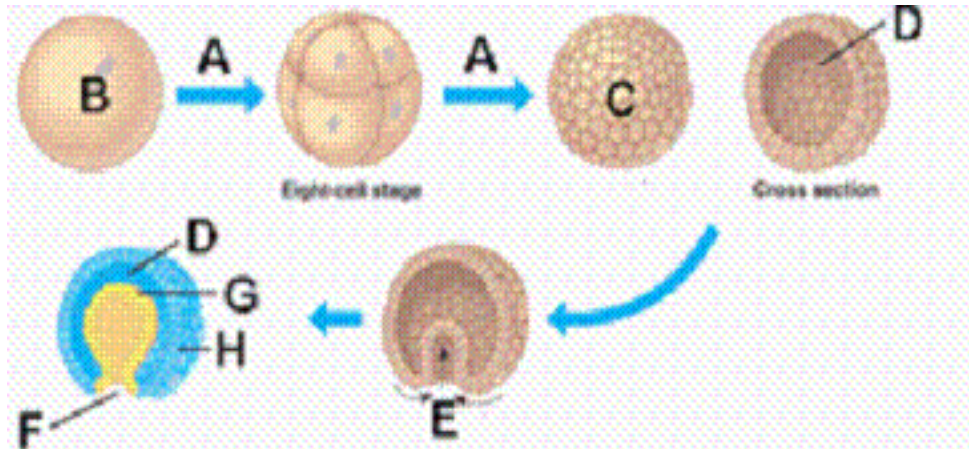
49. What component of the immune system is represented below?



- a. antibody
- b. antigen
- c. histamine
- d. interferon

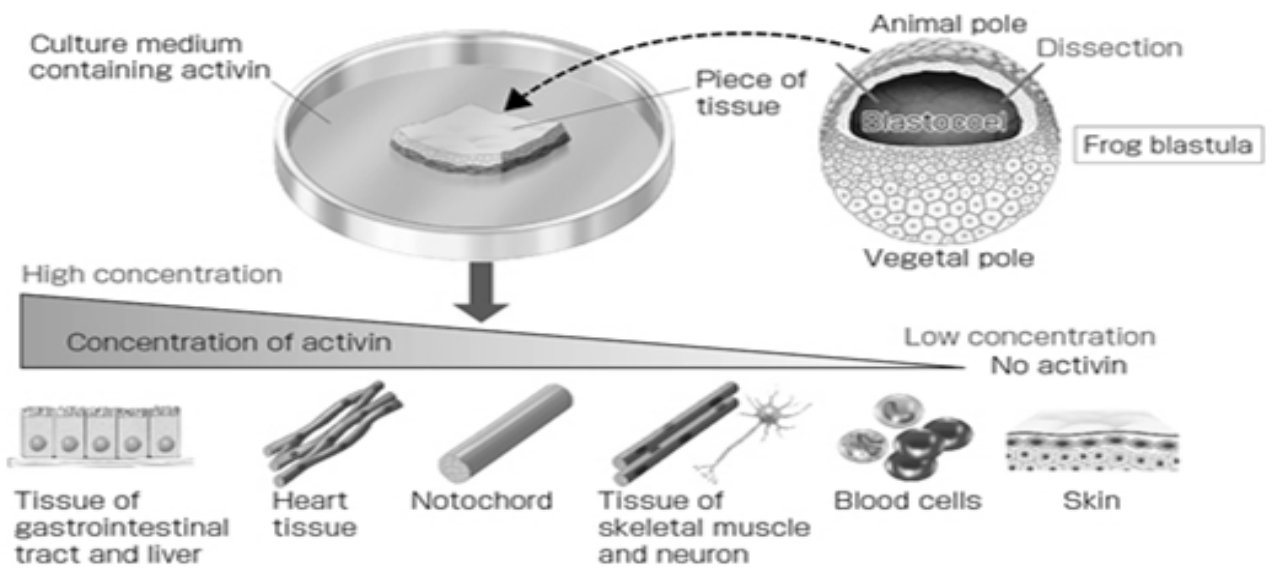


50. Identify C, D and F in the diagram below.



- a. cleavage, blastula, gastrula
- b. morula, blastula, gastrula
- c. blastula, blastocoel, blastopore
- d. fertilization, induction, invagination

51. A piece of tissue is removed from a frog blastula and cultured in a culture medium containing activin, an inducer. The results are shown below. What can be deduced?



- a. Tissue formation is predetermined prior to the formation of the blastula.
- b. The formation of the tissue is random and not induced by activin.
- c. The formation of the tissue is from the inside to the outside of the organism.
- d. The formation of tissues is induced depending on the concentration of activin.

52. A child is born without a fully developed bladder. This problem most likely began early in development during the formation of

- a. morula
- b. mesoderm
- c. ectoderm
- d. endoderm

53. Dr. Foteini Hassiotou from Italy announced that she had found pluripotent cells in breast milk that were from the three initial germ layers. What types of cells did she find?
- Animal cells
  - Embryonic stem cells
  - Adult stem cells
  - Multipotent cells
54. Thermoregulation, osmoregulation and excretion, compensate for fluctuations in the external environment. Animals can use these controls,
- to create energy
  - to communicate problems
  - to achieve homeostasis
  - to change environmental conditions
55. What are two body systems work together and use signals to coordinate body functions?
- skeletal and muscular systems
  - digestion and immune systems
  - excretory and respiratory systems
  - endocrine and nervous system
56. Lysozyme is a small protein consisting of a single polypeptide chain of 129 amino acids. How would you calculate the number of possible different proteins 120 amino acids long that could be built using 20 amino acids?
- $129^{20}$
  - $20^{129}$
  - $20 \times 129$
  - $20 (129) \times 20$
57. What would be the approximate volume and surface area respectively for a cuboidal-like cell that measures 2.5mm by 3.0mm by 1.75mm?
- $13.13\text{mm}^3$  and  $34.25\text{mm}^2$
  - $13.13\text{mm}^3$  and  $13.13\text{mm}^2$
  - $2.18\text{mm}^3$  and  $13.13\text{mm}^2$
  - $9.18\text{mm}^3$  and  $25.77\text{mm}^2$
58. If the diameter of a spherical cell goes from 1 to 2, its surface area goes from 3 to \_\_\_\_.
- 4
  - 6
  - 12
  - 18
59. A cell is not limited by its surface area to volume ratio only. Cells contain 100's to 1000's of structures (organelles) within the cell membrane. In order for a cell to survive, the cell membrane needs extracellular support. Cell walls enable plant cells to be larger. What form of extracellular support do animals have?
- waxy secretions
  - oligosaccharides
  - cytoskeleton
  - glycocalyx
60. The characteristics listed in I, II, III below describe which type of tissue listed in the choices?
- multinucleated coenocytes
  - contains a red pigmented fiber that stores oxygen
  - sarcoplasmic reticulum that stores calcium ions
- connective
  - muscle
  - epithelial
  - nervous

**NEW JERSEY SCIENCE LEAGUE**  
**Biology II Exam: White paper test**  
**Biology II Answer Key**  
**JANUARY 15, 2015 (Corrected)**

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

**Science League Biology II Exam WHITE EXAM**  
**February 12, 2015 Yellow corrections.**

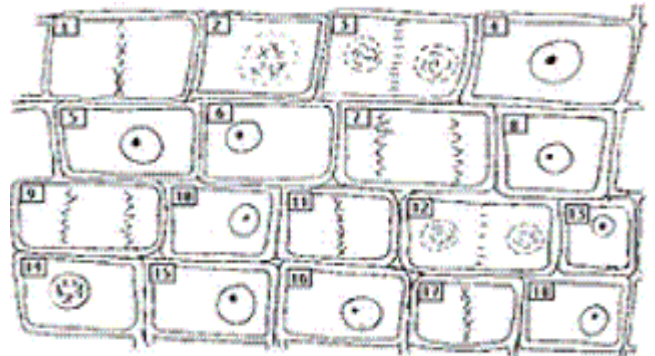
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- In an individual organism, which of the following characteristics are the same in muscle cells and gut cells?
  - Proteins formed
  - Expression of genes
  - Genome
  - Length of the cell cycle
- Yeasts can be used to study human cancer because yeasts and humans:
  - share a genetic code
  - have exactly the same genome
  - have the same number of chromosomes
  - multiply cells at the same rate

- The time for each phase of mitosis can be calculated using the following formula;

$$\text{time for a phase} = \frac{\text{number of cells in a phase}}{\text{total number of counted cells}} \times \text{minutes of mitosis}$$

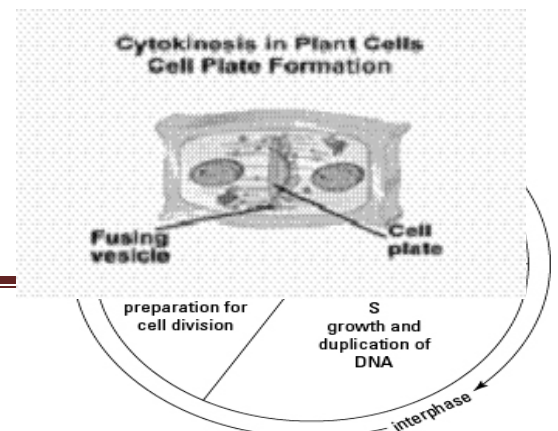
The plant cells shown in the diagram take 270 minutes from interphase to interphase. How many minutes does telophase take to complete?



- 18 min.
- 30 min.
- 180 min.
- 240 min.

- Vesicles travel on nonkinetocore fibers and fuse to form the plants cell plate as shown in the diagram below right. From what cell organelle do the vesicles originate?

- ribosomes
- vacuole
- endoplasmic reticulum
- golgi apparatus



[Type text]

5. Mature nerve cells are incapable of cell division. Using the cell cycle pictured below right determine which stage of the cell cycle these mature nerve cells would be found?
- G1
  - S phase
  - G2
  - M
6. A bacterial cell gives rise to two genetically identical cells by
- nondisjunction
  - binary fission
  - conjugation
  - mitosis
7. Dmitry Kuksin, used Jurkat cells (human T lymphoblast cell line) to analyze how the drug nocodazole affects the cell cycle. A timed test of gated samples of jurkat cells stained with DNA binding fluorescent dyes are divided into treated (nocodazole) and nontreated groups. "Gated" cells are cells that have been arrested at a given point in the cell cycle. Below are tables of the results. Determine from the tables where this drug prevents the cell cycle from proceeding.

Control Cell Population	% of Gated Cells	Concentration (10 <sup>6</sup> cells/mL)
Total	100	2.0
Sub G <sub>1</sub>	0.7	0.1
G <sub>0</sub> /G <sub>1</sub>	55.9	1.1
S	10.2	0.2
G <sub>2</sub> /M	30.6	0.6

Nocodazole (0.05 ug/ml) Treated Cell Population	% of Gated Cells	Concentration (10 <sup>6</sup> cells/mL)
Total	100	2.1
Sub G <sub>1</sub>	0.1	0.1
G <sub>0</sub> /G <sub>1</sub>	17.0	0.4
S	8.0	0.2
G <sub>2</sub> /M	69.2	1.4

- G<sub>1</sub>
  - G<sub>0</sub>/G<sub>1</sub>
  - S
  - G<sub>2</sub>/M
8. The Law of Dominance for a trait is demonstrated best by which of the following cross?
- HH X Hh
  - Hh X Hh
  - HH X hh
  - hh X hh
9. The antiparallel relationship of the two strands of DNA refers to the:
- the helix configuration of the strands.
  - alternative branching pattern of the strands.
  - alignment of the strands, with one strand starting with a 3' carbon and the other with a 5' carbon.
  - alignment of the strands, with one strand starting with a purine, and the other with a pyrimidine.
10. Energy necessary for making a DNA molecule comes directly from:

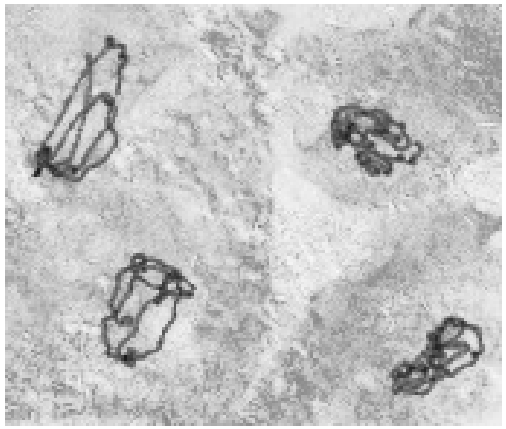
- a. proton pumps
  - b. electrochemical gradients
  - c. from glucose
  - d. releasing phosphates
11. During S phase of mitosis, DNA polymerase is required for the duplication of DNA. When is the DNA polymerase synthesized?
- a. G<sub>1</sub> phase
  - b. G<sub>2</sub> phase
  - c. S phase
  - d. M phase
12. Which of choices below shows the correct sequence in which the components participate in the expression of a gene for tRNA?
- a. RNA polymerase - spliceosome - ribosome
  - b. ribosome - RNA polymerase - spliceosome
  - c. RNA polymerase - ribosome - spliceosome
  - d. ribosome - spliceosome - RNA polymerase
13. How does the diversity of cell types within a human arise from the same genome?
- a. different sequences act as exons and introns creating a diversity of transcripts and producing different cellular products
  - b. variations in maternal exposure to chemicals prior to fertilization of the egg
  - c. crossing over events generate a mixture of genomes patterns encoding different patterns of cellular expression
  - d. different patterns of nutrition always impact genome expression of cell types.

14. What kind of mutation is modeled in the diagram below?

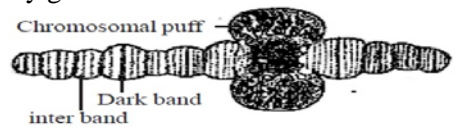
**KLMNOP → KLONMP**

- a. translocation
  - b. deletion
  - c. addition
  - d. inversion
15. What is the correct order for the following events in excision repair of DNA?
1. DNA polymerase adds correct bases in 5' to 3' direction
  2. Damaged bases are recognized
  3. DNA ligase seals the new strand to existing DNA
  4. Part of single strand is excised
- a. 1, 2, 3, 4
  - b. 2, 1, 3, 4
  - c. 2, 4, 1, 3
  - d. 4, 2, 3, 1

16. A student research project involved removing the salivary gland of fruit fly instar. After crushing the tissue and staining with acetyl-carmin, she observed giant chromosomes under high power, as shown below. She was observing:



- a. chromosome in meiotic stages
  - b. polynucleotide strands of DNA
  - c. epithelia cells with nuclei
  - d. polytene chromosomes
17. The student's diagram of her giant chromosome labeled chromosome puffs is shown below. What is probably occurring in the puff of the salivary gland?



- a. RNA synthesis
- b. replication of DNA
- c. translation of DNA to protein
- d. mitosis

18. Sperm of the lab rat, *Rattus norvegicus*, contain 22 chromosomes. How many chromosomes are contained in rat meiotic cells at metaphase of meiosis II?  
 a. 11                      b. 22                      c. 44                      d. 88
19. A plant of genotype AaBbCc is allowed to self-fertilize. Assume that A, B, and C are dominant to a, b, and c, respectively, and all three genes assort independently. What proportion of the offspring can we expect to have the same phenotype as the parent plant?  
 a. 8/27                      b. 16/64                      c. 27/64                      d. 64/128
20. How many different types of gametes are produced by an individual of genotype AaBbCCddEeFFGg? Assume that all seven genes assort independently.  
 a. 5                                      c. 14  
 b. 7                                      d. 16
21. Alpha- Thalassemia, a form of anemia, is inherited in humans as a recessive trait. Two normal parents have a child affected with Thalassemia. If this couple has 3 additional children, what is the probability that none of these children will be affected by Thalassemia?  
 a. 3/64                      b. 27/64                      c. 1/2                      d. 3/4
22. Consider an X-linked recessive linked lethal mutation designated m, in *Drosophila*. Homozygous females (m/m) and hemizygous males (m/Y) die as early embryos; heterozygous females (m/+) are unaffected. Heterozygous females (m/+) are mated with normal males. Which statement most accurately describes the sexes of the living offspring?  
 a. There will be twice as many males as females.  
 b. There will be twice as many females as males.  
 c. There will only be females born.  
 d. There will be equal numbers of males and females.
23. From the following linkage data, what would be the order of the genes on a linkage map of the genes a, b, c, and d?

Genes	Two-Factor Map Distance in centimorgans
<i>d and c</i>	10 cM
<i>c and a</i>	13 cM
<i>a and d</i>	3 cM
<i>b and c</i>	18 cM
<i>b and d</i>	8 cM

- a. a, b, c, and d                      b. b, a, c, and d                      c. b, a, d, and c                      d. c, a, d, and b
24. *Triticale* is an allohexaploid formed by crossing a tetraploid species of wheat with a diploid species of rye and allowing the hybrid to double its chromosome number. The monoploid number of both wheat and rye is 7. How many chromosomes does *Triticale* contain in its somatic cells?  
 a. 6                      b. 7                      c. 14                      d. 42
25. Bacteriophage genomes (those contained within the virus particle itself) are either single- or double -stranded. The base composition of five bacteriophage DNAs are shown in the table below. Which of these bacteriophages contains single-stranded DNA within the virus?

Base Composition
------------------

Phage	A	G	T	C
<b>P4</b>	25.2%	24.8%	25.2%	24.8%
<b>C2</b>	31.8%	18.2%	31.8%	18.2%
<b>IKe</b>	25.1%	21.6%	34.3%	18.9%
<b>fd</b>	24.6%	20.7%	34.5%	20.2%
<b>PZA</b>	30.2%	19.8%	30.2%	19.8%

- a. P4                      b. C2                      c. IKe                      d. PZA

26. The sequence of a short strand of DNA is shown below. What is the sequence of an RNA strand complementary to this DNA indicating the 5' and 3' termini of the RNA?

5'CATCGACATTGCGAGC3'

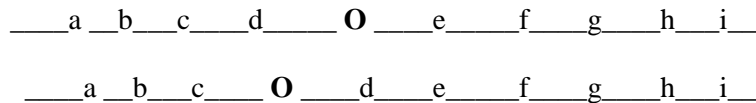
- a. 5'GCUCGCAAUGUCGAUG3'    c. 5'GCUCGACUGUCGAUGC3'  
b. 3'GUAGCUGUAAGCUCGC5'    d. 3'GTAGCTGTAACGCTCG5'

27. On a lagging strand of DNA synthesis, what is the relative order in which the following enzymes function during the synthesis of an Okazaki fragment and its subsequent incorporation into a high molecular weight DNA?

1. DNA polymerase II    2. DNA primase    3. DNA ligase    4. DNA helicase

- a. 2, 1, 3, 4                      b. 1, 2, 4, 3                      c. 4, 1, 2, 3                      d. 4, 2, 1, 3

28. What kind of chromosomal mutation is illustrated in the diagram of two homologous chromosomes below, where **O** represents the centromere?



- a. Paracentric inversion                      c. Translocation  
b. Pericentric inversion                      d. Deletion

29. A tRNA has the anticodon 5'UAC3'. To which of the following codons is this anticodon complementary?  
a. 5'-CAU-3'                      b. 5'-AUG-3'                      c. 5'-GUA-3'                      d. 5'-UAC-3'
30. Midway through the synthesis of a particular mRNA molecule in a bacteria, a radioactive ribonucleotides are added to the growth medium. Synthesis of the RNA is completed. Where will the radioactive nucleotides be found?  
a. 5' end                      b. 3' end                      c. RNA's middle                      d. amino acids

31.                      5'GCCTATTCAGGAATCAACACATAGCGGTCG3'  
                            3' CGGATAAGTCCTTAGTTGTGTATCGCCAGC5'

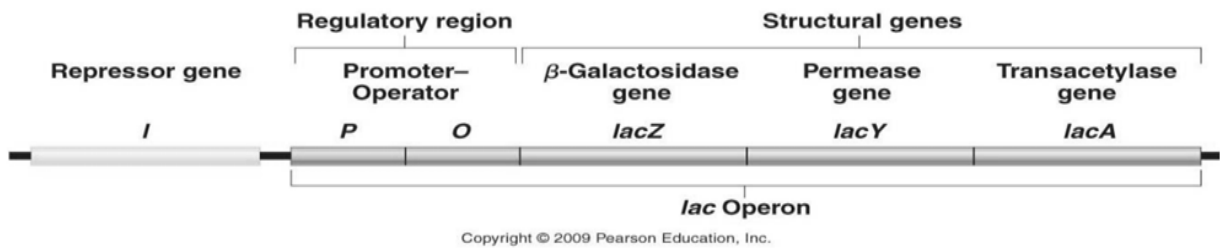
The sequence of a 30 base-pair region of DNA is shown above. If six base primers are sufficient for a PCR run, then which pair of the following oligonucleotide primers will amplify this segment of the polymerase chain reaction?

- Primer 1: 5'ATAGGC3'                      Primer 2: 5'CGACCG3'  
Primer 3: 5'GCCTAT3'                      Primer 4: 5'CGGTCG3'



- a. 1 and 3                      b. 1 and 4                      c. 2 and 3                      d. 2 and 4

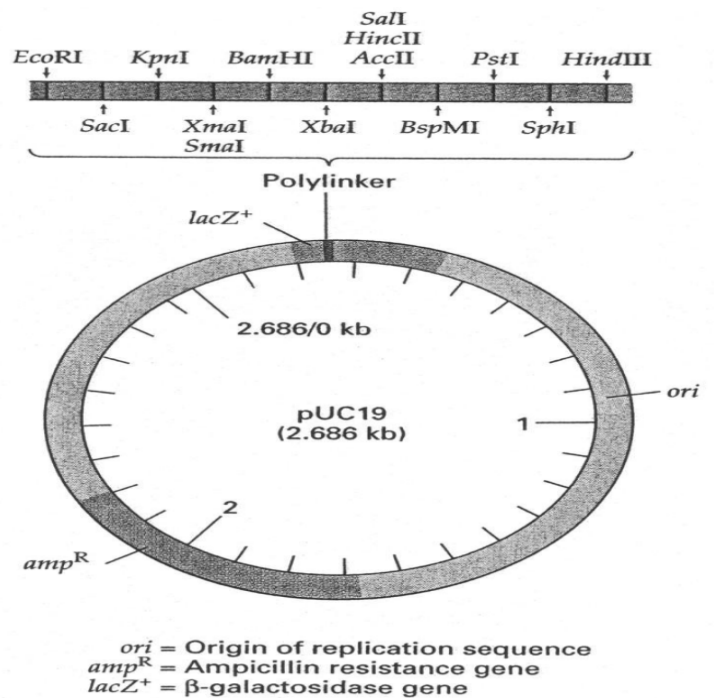
32. The *lac* operon is shown below. What would be a probable impact of mutating the promoter?



- a. Decreased activity of the repressor gene  
 b. Decreased transcription of *lac Y* and *lac A*  
 c. Increased production of lactase  
 d. Decreased binding of repressor protein
33. Which of the following restriction enzymes will produce DNA fragments with complementary 4 base overhang sticky ends and will anneal to each other?

EcoRI	BamHI	HpaII	Bg/II	Sau3A
5'G↓AATTC3'	5'G↓GATCC3'	5'C↓GGC3'	5'A↓GATCT3'	5'G↓GATC3'

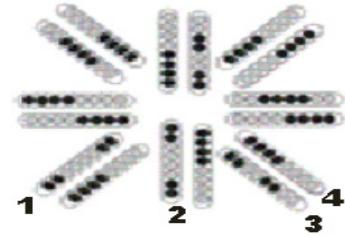
- a. EcoRI and BamHI  
 b. EcoRI, BamHI and HpaII  
 c. HpaII and Sau3A  
 d. BamHI, Bg/II and Sau3A
34. A cloning vector is shown below. If a foreign piece of DNA were inserted into the multiple cloning site, a.k.a. the polylinker of the plasmid, then the cells transformed with the recombinant DNA would NOT grow on:



[Type text]

35. The diagram to the right is a diagram of *Sordaria perithecium* with asci showing ascospores? Which of the asci numbered 1, 2, 3, 4 demonstrates crossing over?

- 1 and 2
- 1, 2 and 3
- 3 and 4
- 4 only



36. Viruses with RNA genomes have higher rates of mutations than viruses with DNA genomes. What would best explain this difference?

- DNA viruses go through the lysogenic cycle more often than RNA viruses.
- RNA viruses go through the lytic cycle faster than DNA viruses.
- DNA viruses lack replication error-checking mechanisms.
- RNA viruses lack replication error-checking mechanisms.

37. In which of the following situations would Mendel's laws of segregation and independent assortment be least upheld?

- Two genes on separate chromosomes
- Two genes very close to each other on the same chromosome
- Two genes on opposite ends of the same chromosome
- A gene on the X chromosome and a gene on the Y chromosome

38. What is the maximum number of amino acids in a protein whose gene encodes 90 nucleotides?

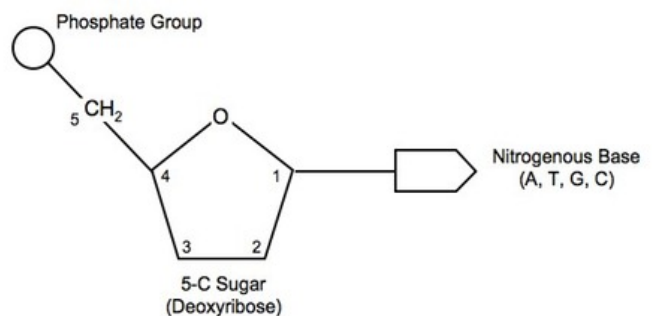
- 30
- 45
- 90
- 180

39. In humans, some aberrant phenotypes, such as polydactyly (extra fingers and toes), are seldom evident in the general population, even though they are controlled by dominant alleles. This is most likely due to which of the following?

- genomic imprinting
- extracellular recessive genes influence
- recombinant and independent assortment
- Most aberrant phenotypes are produced by recessive alleles

40. The molecular fragment below right is common in all living organisms. Which choice does this fragment represent?

- nucleotide
- nucleoside
- nucleosome
- nucleic acid

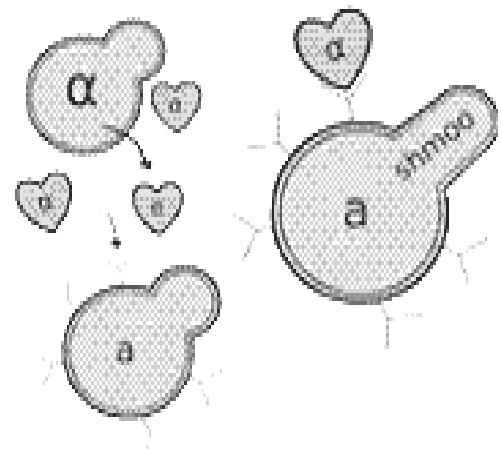


41. Albino plants die before producing seeds. The trait for albinism does not disappear completely because:

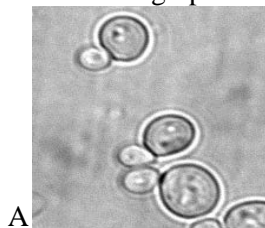
- albinism must be controlled by multiple alleles
- many plants are heterozygous
- darkness activates the gene for albinism
- epistasis influences the gene expression

42. Blood type consists of multiple alleles,  $I^A$ ,  $I^B$ , and  $i$ . Mr. Brown has O type blood and Mrs. Brown has AB type blood. Their baby :
- is a universal donor
  - is a universal recipient
  - may have AB type blood
  - may have B type blood
43. In *Drosophila*, two genes for different traits are located on the same chromosome and have a crossover frequency of 0.75 percent. Subsequent crosses between members of the culture produce offspring with phenotypes that suggested the two genes assorted independently. A reasonable explanation for the unusual chromosomal behaviors is
- mutation
  - inversion
  - translocation
  - epistasis
44. Nondisjunction involving the X chromosome may occur during oogenesis and produce two kinds of eggs. If normal sperm fertilize these two types of eggs, which of the following pairs of genotypes are possible?
- XX and XY
  - XXY and XO
  - XYY and XO
  - XYY and YO
45. Colorblindness is an X-linked recessive trait. Two normal-vision parents produce a colorblind child. What are the chances the next child will be a colorblind daughter?
- 50%
  - 25%
  - 12.5%
  - 0%
46. Two *Drosophila* are crossed several times and produce a total of 106 females and 48 males. The deviation from the expected 1:1 ratio is too great for chance alone to account for the difference. What other factor could account for this difference?
- sex inheritance does not follow independent assortment laws
  - a sex-linked lethal gene is expressed in males
  - the maternal genes are stronger than male genes
  - it is a random process that occurs without any genetic influence

47. Examine the life cycle of a yeast cell and the specific action of the two types of haploid cells,  $\alpha$  and  $a$ . What process occurs to initiate the formation of a shmoo to create a diploid zygote?
- Autocrine signaling to self
  - Paracrine signaling of pheromone
  - Synaptic Signaling for response
  - Direct contact of cell surfaces

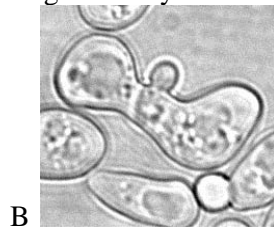


48. Which of the micrographs of yeast stage's life cycle show karyogamy of two haploid shmoos forming a zygote?



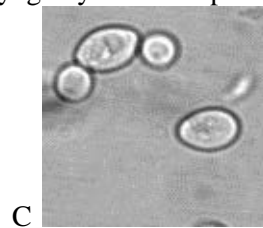
A

a. A



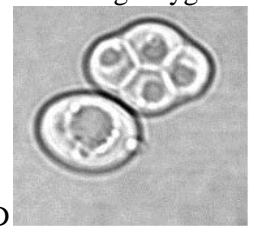
B

b. B



C

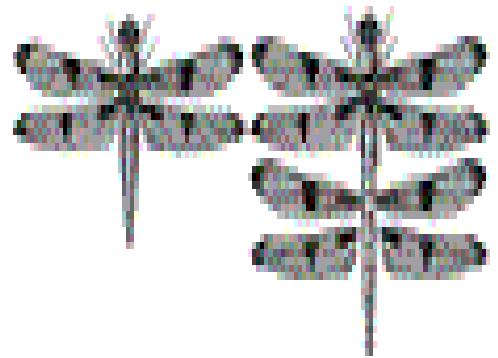
c. C



D

d. D

49. The diagram to the right demonstrates that mutations occur in the homeobox genes. These genes then develop extra thoracic segments with wings as shown. What is the function of the homeobox and its genes?

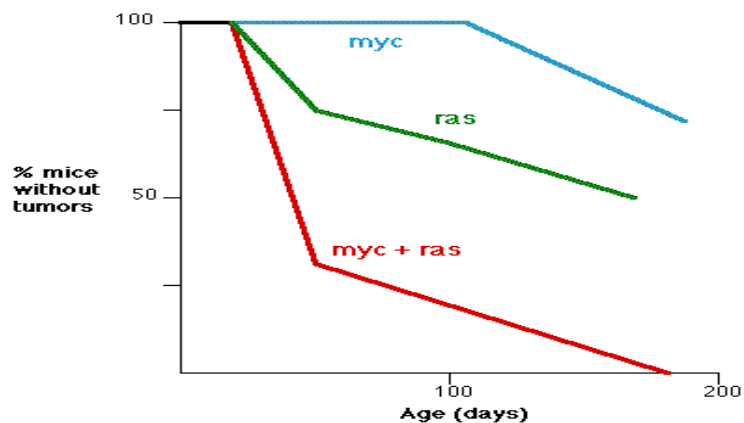


- a. doubling the size of an organism
- b. development of the organism
- c. pattern and position formation
- d. metamorphosis

50. A flowering plant, Queen Anne’s lace, produces seeds from unfertilized diploid cells in the embryo sac. The plant’s reproductive adaptation is:

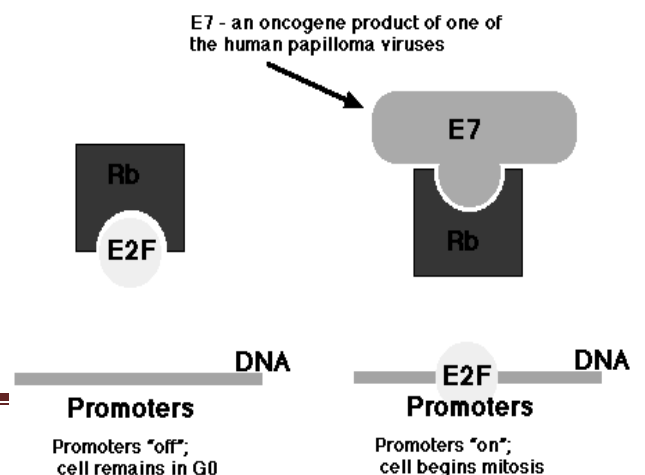
- a. Fragmentation
- b. Vegetative reproduction
- c. Parthenogenesis
- d. Pre-meiotic insemination

51. The graph below comes from an experiment performed by E. Sinn, and shows the fraction (%) transgenic mice without tumors as a function of age and their corresponding oncogenes (*myc* and *ras*). What conclusion can be drawn from these data?



- a. *Myc* gene was not turned on
- b. The oncogenes *myc* and *ras* act synergistically
- c. Neither oncogene is capable of producing tumors on its own
- d. *Myc* gene is turned on before the *ras* gene.

52. Below right are two strains of the human papilloma virus, HPV-16 and HPV-18, are implicated in both cervical cancer and throat cancer. The viruses produce E7 proteins that bind to Rb proteins thereby releasing E2F transcription factors. These, in turn, bind to promoters of oncogenes (see diagram below), turning these genes “on”. What can be inferred about how E7 works?



- a. Without E7, cells cannot become cancerous.
- b. Cancer cells cannot remain in G<sub>0</sub> of the cell cycle.

[Type text]

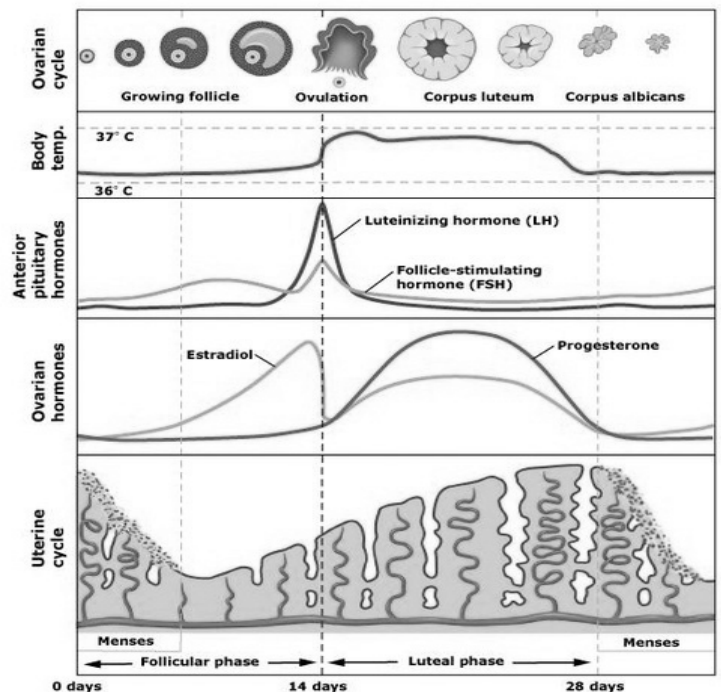
- c. E2F and E7 collaborate to promote normal cell growth.
- d. In the absence of E7, E2F is free to bind to DNA.

53. Mice have been cured of cancer by treating them with a peptide that turns on production of the p53 protein in the tumor cells. The p53 triggers the cell to commit suicide by apoptosis. However, since cells have a limited number of turnovers, there may be a tradeoff involved: excess production of the p53 protein leads to accelerated...
- a. aging
  - b. respiration
  - c. growth
  - d. transport
54. A zoologist working with unfertilized egg cells of sea urchins and frogs used needles and hypertonic solutions to stimulate eggs. What is most likely the investigative purpose of her experiment?
- a. Can unfertilized egg cell of sea urchins and frogs be cloned
  - b. Can artificially stimulated unfertilized egg cells of sea urchins and frogs undergo cleavage?
  - c. Can sea urchin and frog egg cells undergo plasmolysis?
  - d. Can marine organisms respond to more physical abuse than freshwater organisms?
55. Apoptosis is important in the soil worm, *C. elegans* development that it removes excess
- a. nerve cells
  - b. skin cells to form limbs
  - c. red blood cells
  - d. cancer cells
56. After you inject ovarian hormones into a male mouse, you would expect to observe the following change
- a. ovulation
  - b. pregnancy
  - c. endometrium thickening
  - d. an increase in body fat
57. Which of the following is a correct sequence of processes that takes place when a flowering plant reproduces?
- a. meiosis→ fertilization→ ovulation → germination
  - b. meiosis→ mitosis→ nuclear fusion→ pollen
  - c. meiosis→ pollination→ nuclear fusion→ formation of embryo and endosperm
  - d. growth of pollen tube→ pollination→ germination→ fertilization

58. Use the chart below right to answer the next two questions.

Peaks of LH and FSH production occur

- a. at the beginning of the follicular phase of the ovarian cycle
  - b. during the secretory phase of the menstrual cycle
  - c. at the end of the luteal phase of the ovarian cycle.
  - d. right before ovulation
59. What hormone is maintained by the corpus luteum through the first trimester of pregnancy?



[Type text]

- a. follicle-stimulating hormone (FSH)
  - b. progesterone
  - c. gonadotropin-releasing hormone (GnRH)
  - d. human chorionic gonadotropin (HCG)
60. Stem cells in a human blastocyst and in umbilical cord blood may be cultured and controlled to
- a. produce human clones
  - b. grow tissues and organs for transplantation
  - c. function as an egg for in vitro fertilization
  - d. function as antibodies against Ebola

NEW JERSEY SCIENCE LEAGUE

Biology II Exam: White paper test

Biology II Answer Key

February 12, 2015 (Correction)

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

March 12, 2015 **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.

- In comparing the history of earth to a calendar year, at approximately what time did our subspecies of *Homo sapiens* appear?
  - December 1
  - December 30
  - one hour before midnight on December 31
  - Six minutes before midnight on December 31
- When a species is exposed to a wide array of open ecological niches, it may undergo an evolutionary process of
  - invasion
  - succession
  - adaptive radiation
  - punctuated equilibrium
- Research has shown that the leopard frogs in the *Rana pipiens* complex in America actually belong to four separate species instead of one. Some combinations of hybrids produce defective embryos. What type of isolation is occurring?
  - mechanical
  - behavioral
  - prezygotic
  - postzygotic
- Under which of the following conditions would you expect rapid evolution of species to occur?
  - among populations in similar habitats
  - large, randomly breeding population
  - among populations exposed to climatic and other environmental changes
  - among populations experiencing the same stabilizing selection
- The half-life of carbon-14 is 5600 years. A fossil that is 22,400 years old would have what amount of normal proportion of C-14 to C-12?
  - 1/2
  - 1/4
  - 1/8
  - 1/16
- Which sequence analysis would yield the most useful data for determining the pattern by which *Homo sapiens* spread through Europe?
  - Comparing mitochondrial DNA sequences from Italians, French and Germans
  - Comparing nuclear DNA sequences for hemoglobin-A from Italians, French and Germans
  - Comparing ribosomal RNA sequences from Italians, French and Germans
  - Comparing Cytochrome-C amino acid sequences from Italians, French and Germans
- A horse ( $2n=64$ ) and a donkey ( $2n=62$ ) can mate and produce a mule. How many chromosomes would there be in a single mule cell?
  - 31
  - 62
  - 63
  - 126
- What prevents horses and donkeys from hybridizing to form a new species?
  - gamete isolation
  - behavioral isolation
  - reduced hybrid viability
  - reduced hybrid fertility
- Two species of orchids have different length nectar tubes and are pollinated by different species of moths. What type of barrier prevents cross-fertilization between species?



- a. habitat isolation
  - b. behavioral isolation
  - c. mechanical isolation
  - d. temporal isolation
10. A scientist observed that the height of a species of aster decreased as the altitude on a mountainside increased. She gathered seeds from sample plants at various altitudes, planted them in a uniform environment, and measured the height of the new adult plants. All of the experimental asters grew to virtually the same height. What can one conclude?
- a. In the cline there are many genetic variations in asters.
  - b. The height variation is influenced more by environmental factors than by genetic factors.
  - c. The differences in the parent plants' heights were due to directional selection.
  - d. Stabilizing selection was responsible for height differences in parent plants.
11. In North America there is a progressive decrease in the size of song sparrows from the north to the south of their range. This is an example of
- a. a cline
  - b. a deme
  - c. interspecific variation
  - d. the founder effect
12. Which of the following structural adaptations is needed to capture food, eat food, escape predators, migrate and find mates?
- a. gonads
  - b. muscles
  - c. digestive tract
  - d. ears
13. Armadillos and spiny anteaters are not related. Both have long snouts, long sticky tongues, and long sharp claws to dig ants out of their nests. What is the best explanation for these similarities?
- a. adaptive radiation
  - b. coevolution
  - c. convergent evolution
  - d. homologous evolution
14. Originally, a pond had variety of long-finned fish and short-finned fish. A disease led to the death of a disproportionate number of long-finned fish to the point where relative frequency of the two forms has drastically shifted. What occurred in this population?
- a. stabilizing selection
  - b. disruptive selection
  - c. gene flow
  - d. bottleneck effect
15. A particular species gives birth to only one offspring at a time and has a relatively long life-span for its body size. Which of the following would be characteristic of this species?
- a. aquatic
  - b. high parental care of offspring
  - c. young can give live birth
  - d. young live independent of parents
16. How is fitness of an organism measured?
- a. By its longevity
  - b. By its success as a predator
  - c. By the number of offspring it produces
  - d. By the variety of habitats it can occupy
17. Which of the following will decrease the genetic variation in a gene pool?
- a. diploidy
  - b. gene flow
  - c. mutations
  - d. selection

18. In *Drosophila*, there are two different alleles of the gene encoding alcohol dehydrogenase,  $Adh^F$  and  $Adh^S$ . A random sample of 150 flies is collected from a wild population and their genotypes for  $Adh$  gene are determined. The results below show the frequency from the 1st generation to the 10th generation. What can be concluded about the latest population of flies?

Genotype	1 <sup>st</sup> Generation Frequency	10 <sup>th</sup> Generation Frequency
$Adh^F/Adh^F$	27%	12%
$Adh^F/Adh^S$	47%	24%
$Adh^S/Adh^S$	26%	64%

- a. This population of flies are in Hardy Weinberg equilibrium  
 b. This population of flies is not in a Hardy Weinberg equilibrium  
 c. This population of flies has disruptive selection occurring.  
 d. This population of flies is selecting the  $Adh^F$  gene
19. Suppose a biologist has a population of *Drosophila* in Hardy-Weinberg equilibrium. If the frequency of the  $Adh^S$  homozygotes is 0.16 then, what is the frequency of the  $Adh^F$  in this population?  
 a. 0.2                      b. 0.4                      c. 0.6                      d. 0.8
20. Using information from question 19, if the population is made up of 2000 flies, what is the total number of heterozygous flies in this population?  
 a. 120                      b. 240                      c. 960                      d. 1920
21. In a particular randomly mating population, approximately one person in 10,000 is an albino. Albinism is inherited as an autosomal recessive allele. What is the frequency of the allele for albinism in this population?  
 a. 0.10                      c. 0.001  
 b. 0.01                      d. 0.0001
22. Evidence that protobionts may have formed spontaneously comes from  
 a. the discovery of ribozymes showing that prebiotic RNA molecules may have been autocatalytic.  
 b. the laboratory synthesis of microspheres, liposomes and coacervates  
 c. the abiotic synthesis of monomers dripping on hot rocks to form polymers  
 d. the fossil record
23. In order to place a newly identified species into a kingdom, the first piece of information you would need to acquire is  
 a. the way in which it acquires food.  
 b. its life cycle.  
 c. whether the organism is multicellular  
 d. the absence or presence of a nuclear membrane
24. The long time lag between the origin of life and the appearance of multicellular life was partly due to the earth's atmosphere lacking which gas?

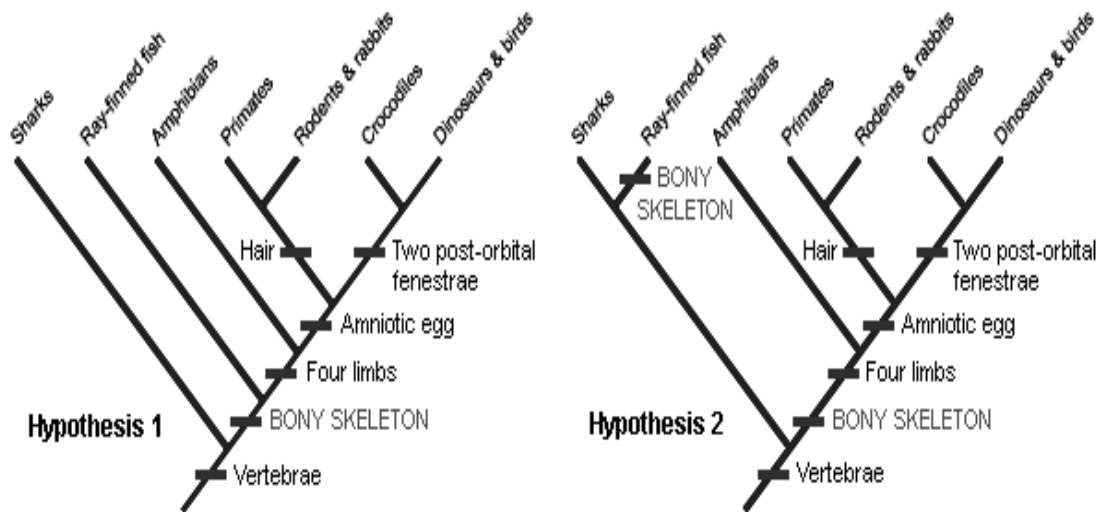
- a. Hydrogen                      b. Nitrogen                      c. Oxygen                      d. Water
25. What is the best explanation for the observation that assemblages of fossils are drastically different in successive geological periods?
- Rapid continental drift has altered the positions of continents, so strata represent different locations on earth.
  - Organisms continue to evolve during periods when fossilization does not occur.
  - Sudden changes in the environment have brought about mass extinctions and the subsequent rebound of biological diversity.
  - Rapid bursts of evolution have occurred due to changes in oxygen concentration.
26. A biologist who is examining and testing plant species from the Panama rainforest in the hope of finding a naturally occurring treatment for cancer is engaged in
- bioprospecting
  - bioremediation
  - bioinformatics
  - DNA fingerprinting
27. A cricket has a diploid genome of 1.2 billion base pairs. The mutation rate is one per 100 million base pair, and the sample population consists of 200,000 crickets. On average, how many new mutations will occur in an individual cricket?
- 0.0002
  - 1.2
  - 12
  - 2.4 million
28. Evidence shows that the common ancestor of mice and humans lived over 80 million years ago. Mice and humans differ by 20 substitutions in their respective globin gene, and rats and mice differ by 5 substitutions. If we use the human-mouse divergence data to establish a molecular clock, how many millions of years ago did the last common ancestor of mice and rats exist?
- 5
  - 20
  - 40
  - 80
29. Overharvesting of large salmon has, over time, reduced the average size of salmon. What type of selection is exemplified?
- natural
  - directional
  - disruptive
  - stabilizing
30. Which of the following would be most conducive to the evolution of sexual reproduction and recombination?
- large populations
  - steady temperatures
  - eliminating sexual pathogens
  - rapidly changing environment
31. Which of the following conditions is least likely to lead to geographic isolation, hence inhibiting allopatric speciation?
- A narrow but deep river divides a population of hummingbirds
  - A flood forms a new lake dividing a population of minnows
  - A new highway separates a population of snails into two groups
  - A narrow but deep river divides a population of white-footed mice.
32. All phylogenetic trees establish relationships among species. A phylogenetic tree is a \_\_\_\_\_.
- hypothesis
  - theory
  - data
  - law of nature
33. What is the order in which energy capturing likely evolved?
- photosynthesis creating oxygen
  - photosynthesis using hydrogen sulfide

3. photophosphorylation using pigments in a membrane

- a. 1, 2, 3                      b. 2, 3, 1,                      c. 3, 1, 2                      d. 3, 2, 1
34. Imagine that a novel form of life is found deep in the earth's crust. The DNA follows normal transcription and translation with one exception; a codon is two base pairs in length. What is the maximum number of different amino acids that could be encoded?  
a. 8                                  b. 12                                  c. 16                                  d. 32
35. If a plant species were to acquire mobility, such that it could easily escape adverse conditions and avoid enemies, which function would be most likely lost over evolutionary time?  
a. cell signaling                  b. cell growth                      c. photosynthesis                  d. plant defense
36. In which of the following species or population would haplotype mapping be challenging or practically improbable?  
a. Dogs because they have a high number of breeds.  
b. Cheetahs because they have extraordinarily low amounts of genetic diversity.  
c. Hummingbirds because they have too many chromosomes.  
d. Salamanders because they have large genomes.
37. Bacteria that normally produce red pigment were exposed to ultra-violet rays for several days. Afterwards, new colonies were cultured. All were red, but one colony was white. What would be a logical next step in this experiment?  
a. draw no conclusion and test further  
b. conclude that the ultra-violet rays mutated the genes of the white colony  
c. conclude that the white colony developed due to an environmental change  
d. expect that the white colony will eventually turn red in time
38. The presence of gill slits in a rabbit embryo supports the idea that  
a. rabbits breathe by gills in the gastrula stage  
b. share a common ancestor with fish  
c. rabbits inherit acquired traits  
d. the theory of regeneration is valid
39. Which statement best explains the evolution of antibiotic resistant bacteria in hospitals?  
a. Overuse of the antibiotic favored bacteria that contained mutant DNA.  
b. Overuse of the antibiotic caused bacteria to mutate and develop resistance.  
c. Patients who were exposed to antibiotics developed resistance to them, allowing the bacteria to proliferate.  
d. There is a greater concentration of infected people in hospitals than in the general population.

40. Parsimony principle uses simplest scientific explanation that fit the evidence. In terms of tree-building that means the best hypothesis is the one that requires the fewest evolutionary changes. In the two examples below in figure 1, which hypothesis about vertebrate relationship is best suited to the parsimony principle?

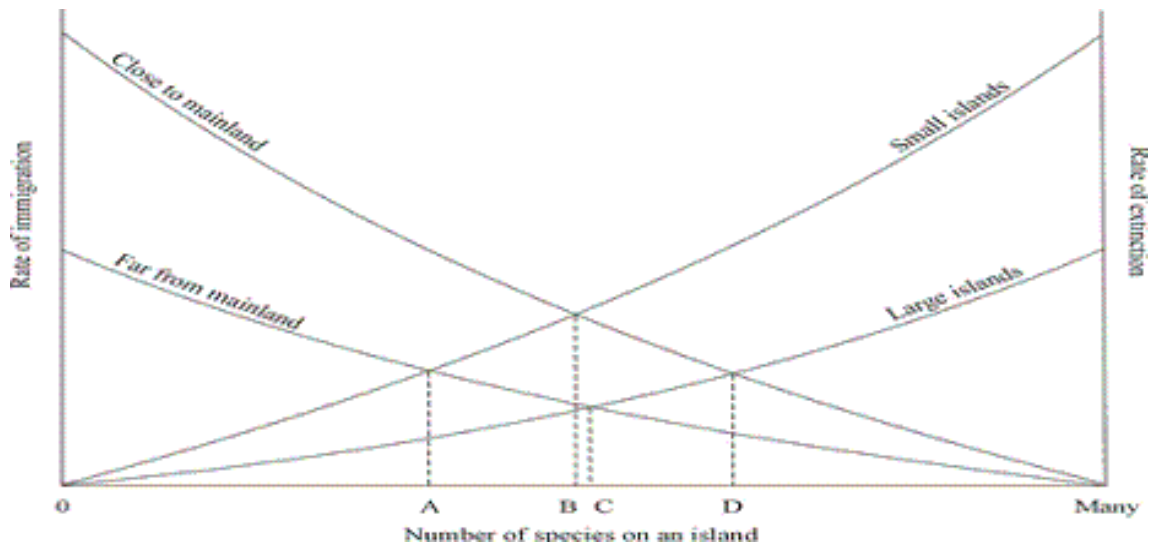
Figure 1



- a. 1                      b. 2

41. Why can birds be classified as tetrapods when they only have two legs?
- Wings are front legs adapted for flying.
  - There are many different types of legs.
  - Bird tails can count as a limb because they are analogous.
  - Classification for birds has been made the exception to the rule.
42. Which of the following might cause a bottleneck effect?
- colonization of new species on a new island
  - non random mating within the species
  - lack of competition for food
  - large scale indiscriminate killing of a population of a species
43. There are 6 different groups of unicellular eukaryotes known as protists. Based on the way in which differentiations are made among the three domains select the **best method** that could be used to distinguish the six groups of protists.
- embryonic
  - fossil
  - genomic or molecular
  - comparative anatomy

44. The graph below depicts “The Island Biogeographic theory.” The theory demonstrates the effect of fragmentation of national parks. Which point on the graph below would land developers need to take into consideration to protect both flora and fauna? Figure 2

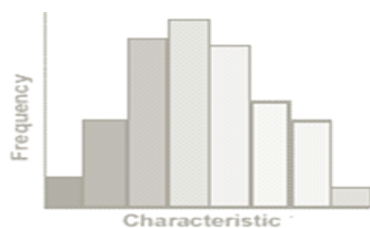


- a. A                      b. B                      c. C                      d. D

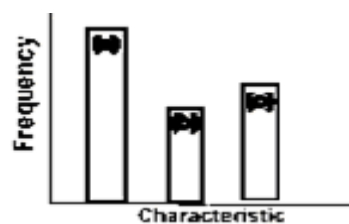
45. Which of the following is an example of the founders effect?
- a small number of fertilized seeds colonized on a new island
  - elephants hunted to near extinction
  - random mating
  - a bee brings pollen from a different area

46. Within a population of a species a trait often shows two basic variation patterns, continuous or discontinuous. In continuous variation there is a complete range of characteristics from one extreme to the other, whereas in discontinuous variation individuals fall into a number of distinct classes or categories. Which graph best corresponds with variation in human ABO blood groups?

Graph A



Graph B



- a. A, continuous                      c. Not Shown  
b. B, discontinuous                      d. Not enough information to determine
47. That the blue-footed male booby engages in a mating dance is an example of
- natural selection
  - dominance hierarchy
  - random mating
  - sexual selection
48. Domesticated mice come in a wide variety of color and coat patterns. Many of these variations are not found in nature. The presence of these variations is a result of

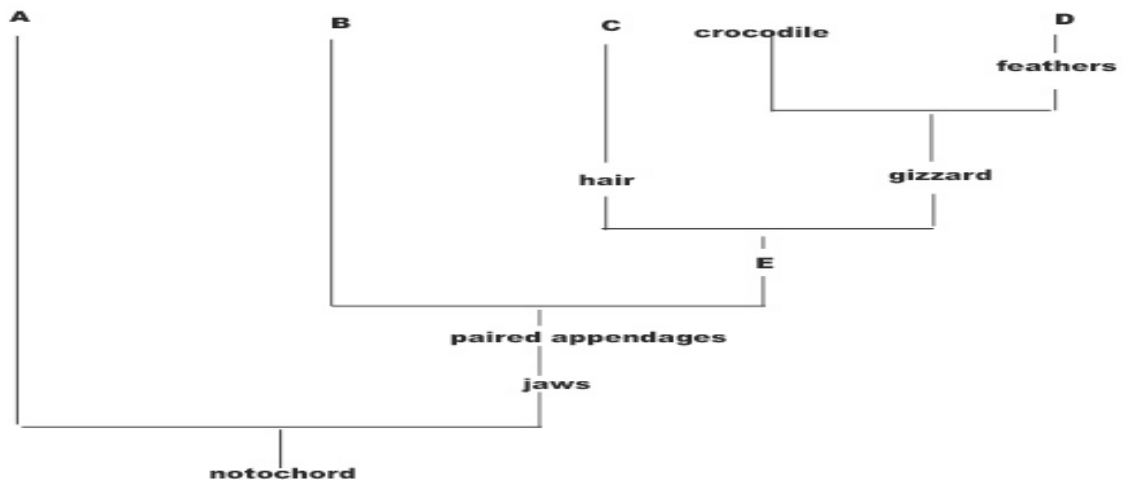
- a. natural selection
- b. sexual selection
- c. artificial selection
- d. geographic isolation

49. Which of the following best supports the statement that mitochondria are descendant of endosymbiotic bacteria-like cells?
- a. Glycolysis occurs in both mitochondria and bacteria
  - b. Mitochondria and bacteria possess similar nuclei
  - c. Mitochondria and bacteria possess similar ribosomes and DNA
  - d. Mitochondria and bacteria have identical cell membranes
50. GAPDH (glyceraldehyde 3-phosphate dehydrogenase) is an enzyme that catalyzes the sixth step in glycolysis. The following data table shows the percentage similarity of this gene and the protein it expresses in humans versus other species. Why is the percentage similarity in the gene always lower than the percentage similarity in the protein for each of the species?

Compared to Human	% of Gene Similarity	% of Protein Similarity
Chimpanzee <i>Pan troglodytes</i>	99.6%	100%
Dog <i>Canis lupus familiaris</i>	91.3%	95.2%
Fruit fly <i>Drosophila melanogaster</i>	72.4%	76.7%
Roundworm <i>Caenorhabditis elegans</i>	68.2%	74.3%

- a. An RNA triplet can code for more than one amino acid leading to multiple protein chains
- b. More than one RNA triplet can that code for an amino acid leading to multiple possible DNA sequences.
- c. The DNA mutates as it makes a protein.
- d. It is due to statistical probability and experimental error.

For the next three questions, use [Figure 3](#)



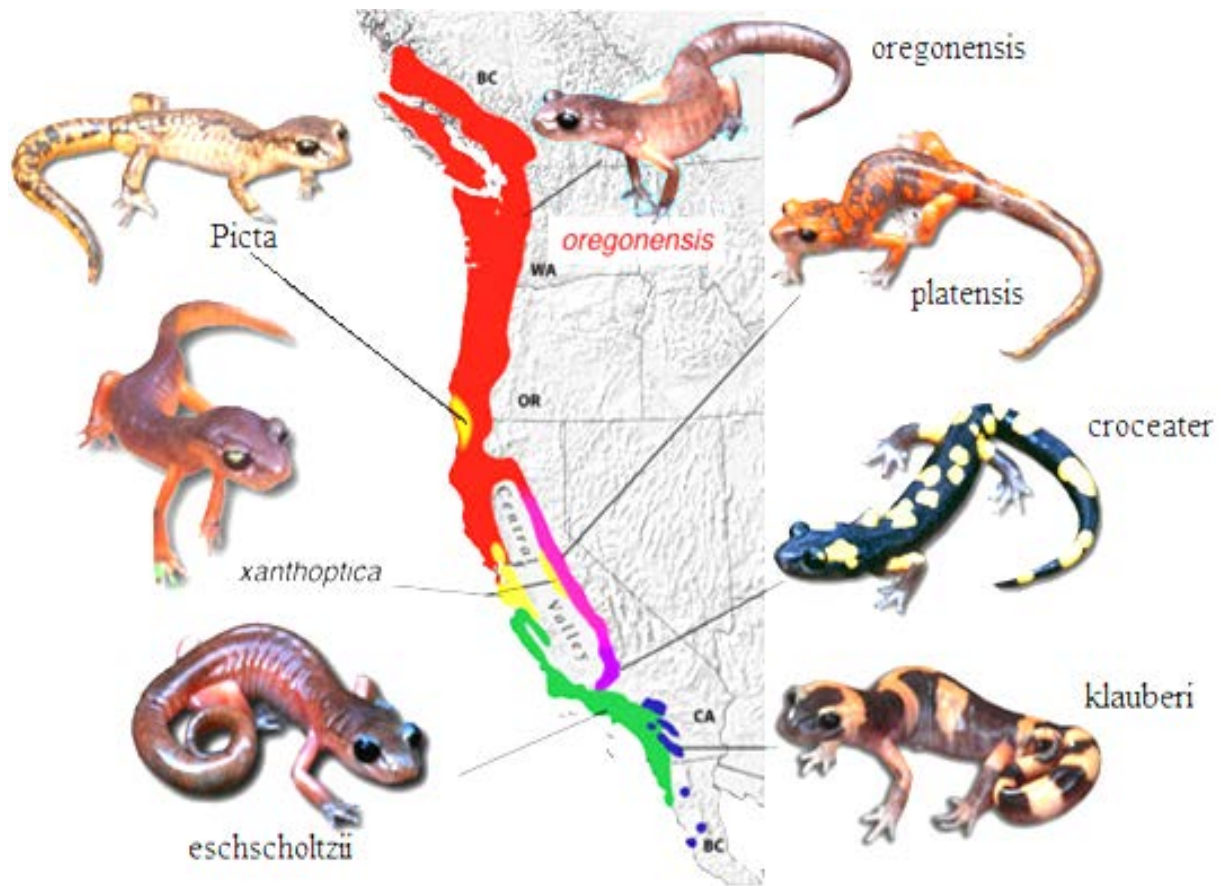
51. Where would **jawless fish** be placed?
- a. A
  - b. B
  - c. C
  - d. D
52. What could be placed at letter **E** in the diagram above?
- a. wings
  - b. scales
  - c. lungs
  - d. gills
53. What organism could be placed at letter **D** in the diagram above?

- a. tiger                      b. crocodile                      c. tuna                      d. flamingo
54. Which of the following is an adaptation in flatworms associated with a parasitic life style?
- a highly branched gastrovascular cavity
  - an extremely large body size
  - an oxygen transport system
  - absorption of nutrients through the body surface
55. The large and remarkable pogonophore annelids live near deep-ocean volcanic hydrothermal vents where food and oxygen are scarce. Many species are able to obtain enough nutrition because
- they can switch to photosynthesis and generate their own food sources
  - their tissues harbor endosymbiotic bacteria that fix CO<sub>2</sub> by oxidizing H<sub>2</sub>S and CH<sub>4</sub>
  - filtering algae out of the sea water
  - feeds on fish
56. A major change in the evolutionary lineage leading to chordates was the
- evolution of a water vascular system
  - ability to filter feed
  - calcification of an internal skeleton
  - development of a dorsal hollow nerve cord
57. Which of the following is a major trait that distinguishes the primates from other mammals?
- hair
  - prehensile tails
  - maternal care of the young
  - dexterous hands with opposable thumbs
58. A paleontologist found a fragment of a fossilized small vertebrate with a hollow bone resembling a sternum. A crystalized mineral ovoid hollow structure was found close to this fragment. Hypothetically, the fossil belong to a (an)...
- amphibian
  - fish
  - lamprey
  - bird



59. A dung beetle engaging in mating behavior has thereby forfeited time foraging for food. The loss of food vs mating is what type of cost to the individual beetle?
- a. breeding            b. opportunity            c. territory            d. energy
60. The subspecies of *Ensatina* salamanders in California exhibit subtle morphological and genetic differences with a geographic distribution that forms a ring and overlaps in Southern California. All of the subspecies exhibit gene flow between one another with the exception of *E. klauberi* and *E. eschscholtzii*. What mechanism best explains this phenomenon?
- a. genetic drift            b. genetic isolation            c. natural selection            d. bottleneck

Figure 4



NEW JERSEY SCIENCE LEAGUE

Biology II Exam: White paper test

Biology II Answer Key

March 12, 2015 (Corrected) none

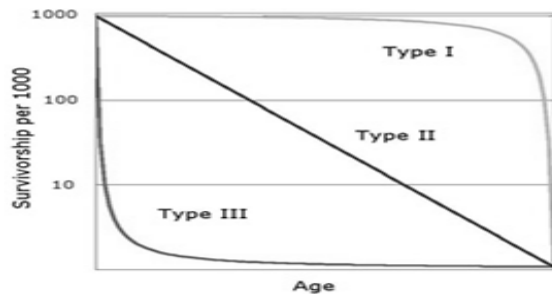
Record onto the area record the # correct

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

April 9, 2015

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.

- Which characteristic of a geographic region would have the greatest influence on the type of ecosystem that forms in a region?
  - ratio of autotrophs to heterotrophs
  - concentration of atmospheric oxygen
  - number of food chains
  - climatic conditions
- The crucian carp, a Scandinavian fish thrives in shallow ponds that freeze over during winter. While other creatures in the pond die from insufficient supply of oxygen, these carp are able to attain energy through another biochemical pathway that does not require oxygen. This characteristic is an example of a
  - feedback mechanism common to carnivores that inhabit shallow ponds
  - favorable adaptive trait that has led to increased survival
  - stage in succession that has lead to a new community
  - gene mutation that occurred because the carp need to maintain ecological stability
- What abiotic factor affects the ability of pioneer organisms, such as lichens, to survive?
  - type of climax vegetation
  - species of algae association
  - type of substratum
  - species of bacteria present
- In order to avoid predators, the clown fish hides unharmed in the stinging tentacles of the sea anemone. The clown fish attracts food to the sea anemone. What is their relationship?
  - mutualism
  - commensalism
  - parasitism
  - predator-prey
- Which organisms directly help to reduce overpopulation in a deer herd?
  - parasites and predators
  - parasites and scavengers
  - decomposers and predators
  - decomposers and consumers
- Shawangunk Grasslands National Wildlife Refuge has been developed from an abandoned airport for the restoration of six bird species that require tall grasses. The refuge manager must remove trees that are beginning to invade the area as a result of
  - direct harvesting
  - evolutionary change
  - genetic engineering
  - ecological succession
- Hawks and owls living in the same area compete for mice. Which situation would lead to the greatest problem in the food supply? If there were to be a (an)
  - increase in the owl population
  - increase in the mouse population
  - decrease in the hawk population
  - decrease in the owl population
- The graph illustrates survival or mortality rates different types of populations. Which type of population would represent an organism that experience enormous predation of young?
  - Type I
  - Type II
  - Type III
  - Type II & III

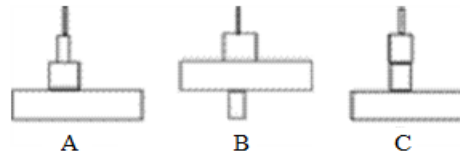


for three  
would

9. The abyssal zone in the deep-ocean communities are dimly lit and have few photosynthetic organisms. What else would be expected to be characteristic of this community?
- a. Primary productivity is high
  - b. High concentration of algae and green plants
  - c. Levels of dissolved oxygen are low
  - d. Contain the most organisms in the ocean

10. Which of the following pyramids of numbers best represents a grassland ecosystem?

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

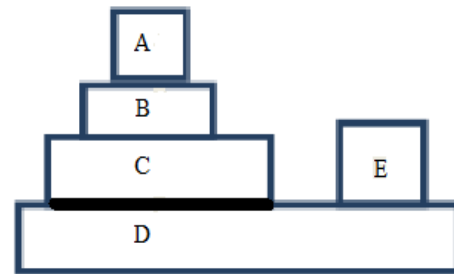


11. Considering their respective positions in an energy pyramid, which foods contain the greatest amount of energy?

- a. bread and peanuts
- b. shrimp and rice
- c. chicken and lettuce
- d. steak

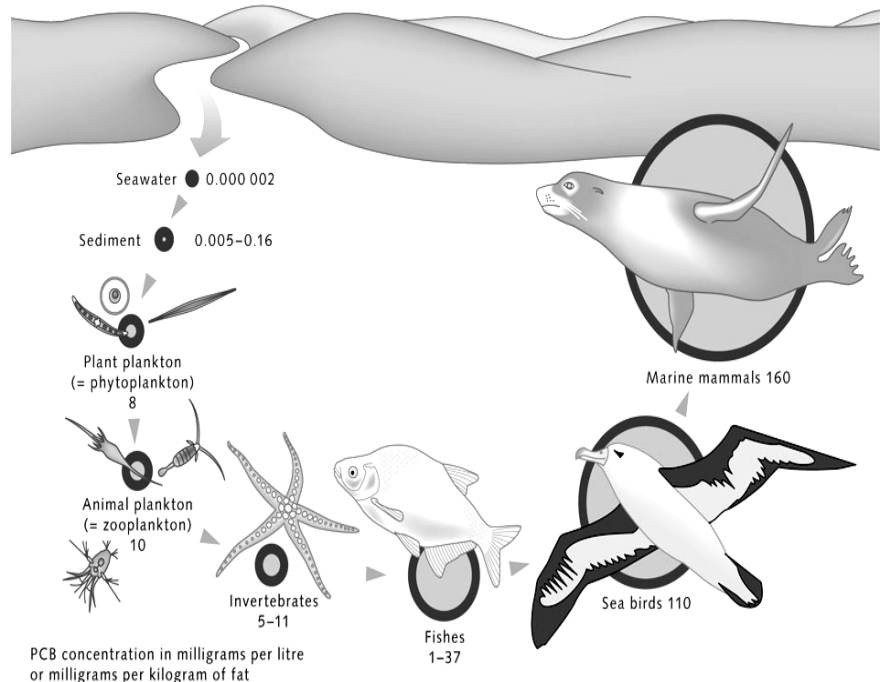
12. In the diagram below, which level represents saprotrophs?

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

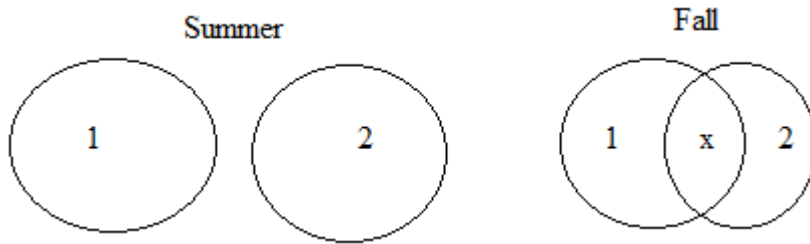


13. What process is best illustrated by the right diagram?

- a. bioaccumulation
- b. biomagnification
- c. bioconcentrations
- d. bioremediation



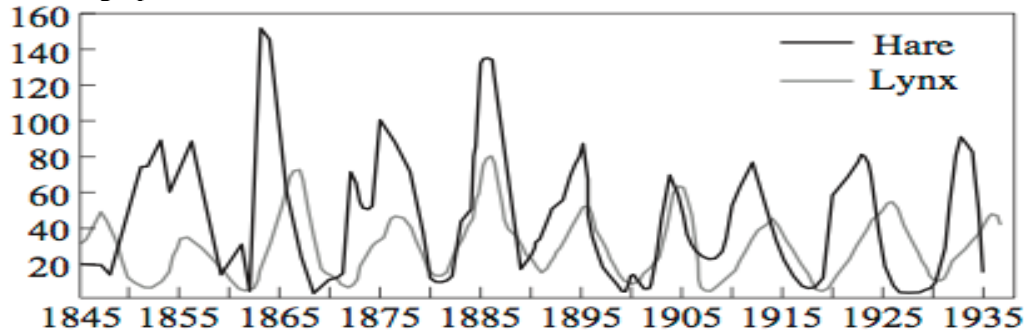
14. The diagram below illustrates the feeding of two populations (1 and 2) in the same ecosystem during the summer and fall. Both populations feed on oak trees. What best explains the x in the diagram?



- 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
15. STATEMENT: “An earthworm lives and reproduces in soil. Through waste elimination and tunneling activities, the worm fertilizes and aerates the soil.”  
 This statement is a description of the earthworm’s...  
 a. environment      b. habitat      c. niche      d. nutrition
16. What characteristic is shared by both predators and parasites? They  
 a. feed on decomposed plants      c. capture and kill animals for food  
 b. live inside hosts      d. attack living food sources
17. In one variety of corn, the kernels turn red when exposed to sunlight. In the absence of sunlight the kernels remain yellow. Which hypothesis best explains this observation?  
 a. Selective breeding is responsible for red kernels.      c. The rate of transpiration effects color expression in corn.  
 b. The presence of red pigment impacts photosynthesis.      d. The environment influences gene expression.
18. Which types of organisms have most likely been reduced in number in an ecosystem where wastes accumulate and nutrients stop cycling?  
 a. Algae and protists      c. Worms and mollusks  
 b. Bacteria and fungi      d. Hawks and owls
19. How do pesticides and many metal compounds disrupt the organisms in successive trophic levels of food pyramids within ecosystems? Pesticides and metal compounds...  
 a. are metabolized rapidly      c. are utilized as coenzymes  
 b. are incorporated into the ornithine cycle      d. accumulate in the tissues of organisms
20. Liebig’s Law of Minimum, states that the least abundant factor determines the makeup of the ecosystem. What is the direct result on a species in the ecosystem, if the limiting factor is space and the area decreases?  
 a. competition between species increases      c. immigration of other species occurs  
 b. all species undergo a population increase      d. survival rates increase

21. Niche sharing species follow the competitive exclusion principle. The better competitors will tend to be the specialists rather than the generalist when resources are limited. Two species of body lice have equal ability to colonize new hosts, such as pigeons. Specialist crawling lice reproduce quickly and outcompete generalist, winged lice. Winged lice, on the other hand, excel at finding a new host to colonize. What is the most reasonable impact of competition-colonization trade-off?
- Succession occurs.
  - Biodiversity increases.
  - Net productivity increases.
  - Extinction rate increases.

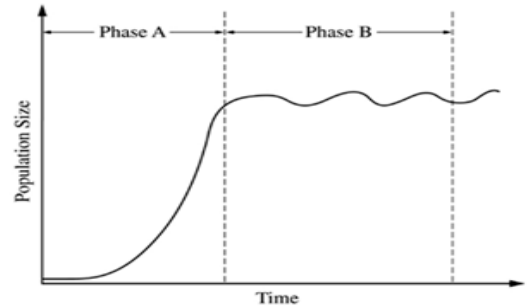
22. What does the graph indicate between 1910 to 1935?



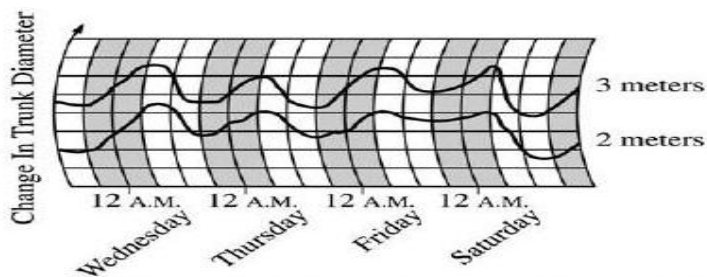
- The slow increase in the hare population was due primarily to interspecies competition.
  - The lynx population decreased due to a change in abiotic environmental factors.
  - An increase in the hare population was accompanied by an increase in the lynx population.
  - An increase in the hare population was accompanied by a decrease in the lynx population.
23. The main reason that large bodies of water moderate the climate of a region is that
- infrared rays of solar radiation are not absorbed by water
  - water releases heat when it vaporizes
  - water is most dense at 4° C
  - specific heat of water helps moderate air temperature
24. Eels that inhabit the Atlantic Ocean, when mature, return to the rivers where they originated. What best accounts for this behavior?
- conditioning
  - habituation
  - imprinting
  - learned
25. What role do chemosynthetic bacteria play in a deep-sea vent ecosystem?
- decomposers
  - primary consumers
  - producers
  - biochemical recycling
26. What defense system does a palatable species, the viceroy butterfly, use to defend against predators?
- aposematic coloration
  - Batesian mimicry
  - Mullerian mimicry
  - exuding pheromones
27. If an exponential population growth of aerobic bacteria occurred in a lake, what would be the next immediate indicator that the ecological balance has been compromised?
- biological magnification of pollutants
  - death of many fishes
  - eutrophication
  - loss of biodiversity
28. In the rain forest light gap, a species of plant dies and decomposes. The soil pH changes so drastically that seedlings of the plant species die. Other plants species,, quickly take advantage of the altered soil by successfully growing and reproducing. What type of change is this an example of?

- a. climax formation
- b. ecological succession
- c. competitive exclusion
- d. interspecific competition

29. Which is an accurate interpretation of the graph?
- a. The population is stable over the entire time it is sampled.
  - b. Food is a limiting factor during phase A.
  - c. Phase A exhibits a linear growth pattern.
  - d. The population growth slows as it reaches carrying capacity.



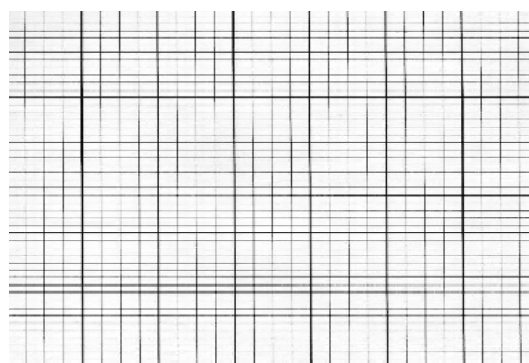
30. Humans should be considered
- a. R strategists, because they can colonize almost any habitat successfully.
  - b. R strategists, because they have a very high birth rate
  - c. K strategists, because infant mortality is high with high maternal deaths
  - d. K strategists, because of their long gestation and long period of childhood.
31. The female of a certain species of moth pollinates the yucca flower at the same time she lays her eggs. The moth larvae hatch and feed on only half of the developing seeds. What type of symbiotic relationship is exhibited?
- a. commensalism
  - b. food chain
  - c. mutualism
  - d. parasitism
32. When a tendril of Poison Ivy comes in contact with a tree, it wraps around the trunk. This response exemplifies...
- a. phototropism
  - b. thigmotropism
  - c. gravitropism
  - d. geotropism
33. Which of the following is an example of an agonistic behavior?
- a. A subordinate chimp grooms a dominant chimpanzee.
  - b. Two lionesses share a zebra
  - c. A female wolf regurgitates food to feed her nephew
  - d. A blackbird approaches and takes the feeding position of another bird, causing it to fly away.
34. A new plant was discovered and that has an unusually low number of stoma on the undersides of its leaves. For what environment is this plant most likely adapted?
- a. cold and rainy
  - b. humid and sunny
  - c. hot and humid
  - d. hot and dry
35. To study transpiration in tree species, a botanist used a dendrometer to record the daily changes in trunk diameter at two different heights, 2 meters and 3 meters above ground level. In the daytime the tree's diameter decreased. What best accounts for this observation?



- a. Humidity decreases, transpiration decreases, stoma close
- b. Light increases, transpiration increases and stoma open
- c. Temperature increases slightly, transpiration decreases
- d. Winds slow, transpiration increases

36. The number of cricket chirps per minute varies with temperature, as shown in the table below. From this data predict the number of chirps at 60°F

# of chirps	47	71	150
Temp °F	49°F	55°F	75°F



- a. 71
  - b. 81
  - c. 91
  - d. 101
37. Asters are short-day plants and flower in the fall, when there are fewer than 12 hours of daylight. What would you do to get them to bloom in the middle of summer?
    - a. Expose them to moonlight each night.
    - b. After 11 hours of daylight have passed, place them in a darkroom daily.
    - c. Place them in a darkroom at 11 P.M. each night and bring them out at sunrise.
    - d. Place an opaque cover on them each night.
  38. What is the process that replaces energy that is lost from an ecosystem?
    - a. combustion
    - b. respiration
    - c. photosynthesis
    - d. weathering
  39. Truffles, a type of fungus, exist in a mutualistic relationship with trees in an old growth forest. Which of the following best describes such a symbiotic relationship?
    - a. Truffles are producers in the old forest-growth system.
    - b. Truffles produce chemicals that prevent growth of new young trees.
    - c. Truffles are parasites that infect living trees.
    - d. Truffles grow on roots of trees and help roots absorb minerals and nitrogen.
  40. Sea otters feed on sea urchins, and therefore control their population. If the otters didn't eat the urchins, the urchins would eat up the habitat's kelp. Kelp, giant seaweed, is a major source of food and shelter for the ecosystem's crabs, snails, geese and fish. Without sea otters to control the urchin population, the entire ecosystem would collapse. What is the role of the sea otter in this ecosystem?
    - a. Foundation species
    - c. Keystone species





49. Which of the following anatomical adaptations allow rattlesnakes to sense their prey in dim light?
- Rattles transmit heat signals to the brain.
  - Pit organs transduce infrared radiation.
  - Fatty deposits surrounding the jaw pick up vibrations.
  - The pupils of the eyes over-dilate.
50. In an experiment, the environmental temperature in a closed chamber increases from 15 to 25°C. Predict what would happen to the metabolic rate of an ectotherm, such as a lizard and that of an endotherm, such as a mouse, respectively.
- both increase
  - both decrease
  - lizard increases, mouse stays fairly constant
  - lizard stays the same, mouse decreases
51. Male and female hyenas both possess anal glands. When a hyena walks through grass these glands deposit a strong smelling whitish substance; an action called “pasting”. What is the purpose of this behavior?
- to attract females
  - to discourage predators from attacking
  - to mark territory
  - to demonstrate dominance
52. Some animals are well adapted to cold climates. What adaptation do such species tend to exhibit?
- increased tendency to shiver
  - thin layers of body fat
  - reduced density of fur or feathers
  - reduced surface area-to-volume ratio
53. In hot and dry environments, why do mammals rely on evaporative cooling as a last resort to reduce body temperature?
- It is ineffective at dissipating heat.
  - It requires movement of the limbs.
  - It causes dehydration.
  - It requires resetting an animal’s thermostat.
54. What allows dogs to have more acute sense of smell than humans?
- larger amount of mucus in their noses
  - smaller surface area of their nasal epithelia
  - larger number of capillaries in the nose
  - greater density of their olfactory receptors
55. 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.
56. On an arctic island, over the last 75 years, a decrease in average air temperature has reduced the forests of conifers and increased open permafrost with short plants. Which of the following transitions in biomes seems to be occurring?
- Taiga to deciduous forest
  - Taiga to tundra
  - Tundra to taiga
  - Tundra to grasslands
57. In studying meerkats Peter Santema observed, “These results are exciting, as they show us that individuals are not just on the look-out for their own safety, but that the protection of other group members is another motivation for this behavior. Our results thus suggest that vigilance and sentinel behavior in meerkats represent forms of cooperation.” What type of social behavior is described?
- Agonistic behavior
  - Altruism
  - Territoriality
  - Dominance hierarchy

58. When a light is turned on, cockroaches randomly scatter. What type of response is this?  
 a. kinesis                      b. taxis                      c. reflexive                      d. learned
59. 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?  
 a. Light intensity affects the growth of microscopic plants  
 b. Wind currents affect the growth of microscopic plants  
 c. Nitrogen concentration affects the growth of microscopic plants  
 d. Precipitation affects the growth of microscopic plants
60. Bacteria that are classified as saprophytes because they...  
 a. feed on other living things                      c. manufacture food by photosynthesis  
 b. feed on dead organic matter                      d. fix nitrogen

**NEW JERSEY SCIENCE LEAGUE**  
**Biology II Exam: White paper test**  
**Biology II Answer Key**  
**April 9, 2015**

**Record onto the area record the # correct (Corrected)**

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