USA Bio Olympiad 2004 Study Questions

The USABO Open Exam is a 45-minute multiple choice exam focusing on theoretical knowledge of biology. The following are 16 Sets of Study Questions that you may use for students for practice and drill, as well as some of the study ideas mentioned in the Teacher Resource Center.

The answer key page is on the next page, followed by the Study Questions (2 pages per set).

Practicing with these Study Questions:

A. Whole Class review

Have the entire class practice by scheduling Quiz Time at the beginning or end of class. Each set of Study Questions (10 questions per set) should take approx. 15 minutes. As with the USABO, there is no pass or fail with these quizzes. Students should simply try to answer correctly as many questions as they can.

B. Homework Assignments

Give the study questions to the students as homework assignments. Using textbooks, have them research and identify the correct answers on the forms. In this way, it can become a learning experience for all students, even if it is new material with some/all of the questions.

C. Individual Study

Have one or more students study these questions, individually or in small groups. As an incentive to study, perhaps use this as make-up study for missed days, or as extra credit opportunities.

About the Study Questions

The Study Questions are taken from a variety of souces, internal and external. Some of the questions are taken from the following sources, with the remainder from USABO documents. They may not be sold or used for any other purposes than helping students study biology in preparation for the USABO.

- British Biology Olympiad 2001 Archived Exam
  Questions: http://www.iob.org/downloads/Part%20Awebsite.pdf
  Answers: http://www.iob.org/downloads/Part%20AAwebsite.pdf

- International Biology Olympiad Archived Questions
  http://www.ibo-info.org/questions.htm

USABO Study Questions Answer Key

Set 1	Set 2	Set 3	Set 4
1. B	11. D	21. D	31. D
2. E	12. D	22. B	32. B
3. B	13. C	23. B	33. E
4. A	14. A	24. C	34. D
5. C	15. C	25. B	35. D
6. D	16. A	26. D	36. A
7. C	17. B	27. D	37. E
8. B	18. B	28. D	38. B
9. C	19. C	29. A	39. C
10. A	20. E	30. B	40. A
Set 5	**Set 6**	**Set 7**	**Set 8**
41. B	51. D	61. D	71. B
42. B	52. E	62. B	72. D
43. A	53. C	63. A	73. A
44. E	54. B	64. B	74. D
45. C	55. C	65. A	75. B
46. D	56. A	66. D	76. C
47. A	57. C	67. A	77. E
48. E	58. D	68. B	78. D
49. C	59. D	69. A	79. A
50. D	60. D	70. C	80. C
Set 9	**Set 10**	**Set 11**	**Set 12**
81. C	91. B	101. D	111. E
82. C	92. B	102. B	112. C
83. B	93. D	103. E	113. B
84. C	94. A	104. B	114. A
85. C	95. D	105. D	115. B
86. D	96. B	106. A	116. D
87. C	97. B	107. A	117. C
88. A	98. C	108. B	118. B
89. D	99. B	109. D	119. N
90. C	100. B	110. B	120. C
Set 13	**Set 14**	**Set 15**	**Set 16**
121. A	131. C	141. D	151. A
122. A	132. D	142. E	152. D
123. C	133. D	143. D	153. C
124. A	134. E	144. A	154. B
125. C	135. C	145. D	155. C
126. D	136. D	146. A	156. A
127. C	137. B	147. A	157. B
128. A	138. A	148. E	158. A
129. C	139. B	149. D	159. A
130. A	140. D	150. A	160. E

1. Protein synthesis occurs in/on the

[ ] A. nucleus
[ ] B. ribosome
[ ] C. smooth endoplasmic reticulum
[ ] D. lysosome

2. Which of the following biomes has the greatest species diversity?

[ ] A. Temperate Rain Forest
[ ] B. Savannah
[ ] C. Grassland
[ ] D. Temperate deciduous forest
[ ] E. Coral Reef

3. The genetic balance of a population in the sequence of generations is expressed by the Hardy Weinberg Law, which expressed mathematically is:

[ ] A. $H = 2pq$
[ ] B. $p^2 + 2pq + q^2 = 1$
[ ] C. $(p + q) = (p - q)$
[ ] D. $(p + q) \times (p - q) = p^2 + q^2$
[ ] E. $p^2 + pq + q^2 = 0$

4. In a food chain isolated from others, which of the following (measured in kJ m^{-2}) is numerically the greatest?

[ ] A. Net primary production in plants
[ ] B. First carnivore consumption
[ ] C. Herbivore assimilation
[ ] D. Herbivore respiration
[ ] E. Plant biomass increase.

5. Tissues that form long, tough strands, as in the leaf stalk of celery, are:

[ ] A. epidermis
[ ] B. collenchyma
[ ] C. sclerenchyma
[ ] D. parenchyma

6. During migrations, some birds use which of the following as reference frameworks?

I. The sun
II. Constellations
III. Earth's magnetic field

[ ] A. I only
[ ] B. I and II only
[ ] C. I and III only
[ ] D. I, II, and III

7. When the base composition of DNA from bacterium Mycobacterium tuberculosis was determined, 18% of the bases were found to be adenine. What is the [G] + [C] content?

[ ] A. 32%
[ ] B. 36%
[ ] C. 64%
[ ] D. 18%

8. The pH of the lysosome is most nearly

[ ] A. 1.0
[ ] B. 5.0
[ ] C. 7.0
[ ] D. 11.0

9. Which of the following is an example of habituation?

[ ] A. Chickadees learning new songs when they shift to living in large winter flocks from small family groups.
[ ] B. Stalking and attacking litter mates by lion cubs.
[ ] C. Hydra initially contract when gently touched, but soon stop responding.
[ ] D. Yearly migration of golden plovers from Arctic breeding grounds to southeastern South America.

10. Energy is transferred between trophic levels in a food chain. Which of the following stages represents the *least* efficient transfer of energy?

[ ] A. Sun to primary producer
[ ] B. Primary producer to primary consumer
[ ] C. Primary consumer to secondary consumer
[ ] D. Secondary consumer to tertiary consumer
[ ] E. Tertiary consumer to decomposer.

11. The final sere during succession is termed the:
[ ] A. niche
[ ] B. biotic potential
[ ] C. carrying capacity
[ ] D. climax
[ ] E. seral community

12. Brown algae differ from the green algae and red algae in having:
[ ] A. chlorophyll a
[ ] B. differentiated cells
[ ] C. phycocyanin within their cells
[ ] D. Fucoxanthin within their cells

13. Which two functional groups are always found in amino acids?
[ ] A. Amine and sulfhydryl
[ ] B. Sulfhydryl and carboxyl
[ ] C. Carboxyl and amine
[ ] D. Alcohol and aldehyde

14. Woodlice normally live in damp habitats. This is to prevent desiccation and to facilitate gaseous exchange. In regions of low humidity they move about quite rapidly but in a random manner. When they find an area of high humidity they slow down and eventually become stationary. This is an example of:
[ ] A. a kinesis
[ ] B. a taxis
[ ] C. a reflex action
[ ] D. habituation
[ ] E. operant learning

15. Sex-linked recessive alleles are usually carried on:
[ ] A. The homologous part of the X chromosome
[ ] B. An extra Y chromosome
[ ] C. The non-homologous part of the X chromosome
[ ] D. The homologous part of the Y chromosome
[ ] E. An extra X chromosome

16. Populations that are likely to be living at a density near the limit imposed by their resources, are characterized as
[ ] A. *K*-selected
[ ] B. *p*-selected
[ ] C. *Q*-selected
[ ] D. *r*-selected

17. Which of the following is responsible for transcription?
[ ] A. spliceosome
[ ] B. RNA polymerase
[ ] C. DNA polymerase
[ ] D. Ribosome

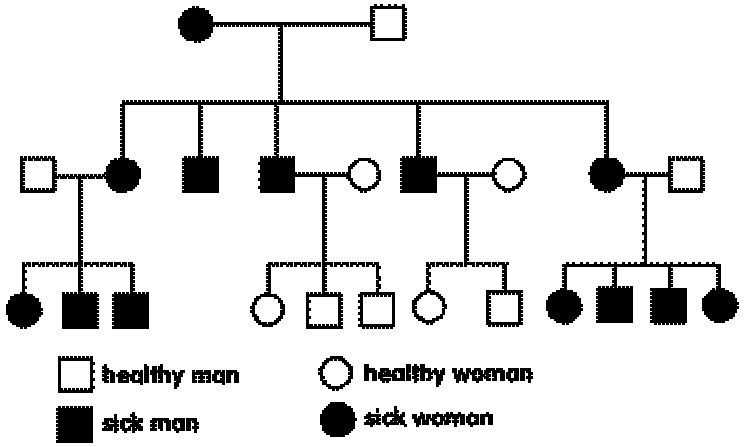
18. Dichlorophenol indophenol (DCPIP) is a blue dye that is decolorized when reduced. After being mixed with DCPIP which one of the following would show the greatest change in color?

[ ] A. Isolated chloroplasts in the dark;
[ ] B. Isolated chloroplasts in the light;
[ ] C. Chlorophyll extract in the dark;
[ ] D. Boiled chloroplasts in the dark;
[ ] E. Boiled chloroplasts in the light.

19. In situation that conflict between attack and flight animals have been noted to behave in a most peculiar fashion e.g. the behaviour of fighting cocks interrupting their fight to peck at the ground for food. What is this kind of behavior called?

[ ] A. Feeding
[ ] B. Ritualisation
[ ] C. Displacement Activity
[ ] D. Aggressive Behaviour

20. The pedigree (see figure) shows an inheritance of a rare form of muscular dystrophy.



The disease is probably caused by a mutation on one locus which is:

[ ] A. recessive, autosomal
[ ] B. dominant, autosomal
[ ] C. recessive, related to the X-chromosome
[ ] D. related to the Y-chromosome
[ ] E. situated in the mitochondrial genome

21. Why is a high-moor bog an extreme habitat?

1 because it is oligotrophic and permanently cold
2 because it allows extreme situations concerning climate on the surface.
3 because it is oligotrophic and has a low pH value

[ ] A. All three explanations are correct
[ ] B. Only explanation 1 is correct
[ ] C. Only explanations 1 and 2 are correct
[ ] D. Only explanations 2 and 3 are correct
[ ] E. Only explanation 3 is correct.

22. Which of the following situations is in operation when blood is being pumped into the aorta?

[ ] A. left ventricle contracted, bicuspid valve open, semilunar valve shut
[ ] B. left ventricle contracted, bicuspid valve shut, semilunar valve open
[ ] C. left ventricle contracted, bicuspid valve open, semilunar valve open
[ ] D. left ventricle relaxed, bicuspid valve shut, semilunar valve open
[ ] E. left ventricle relaxed, bicuspid valve open, semilunar valve shut.

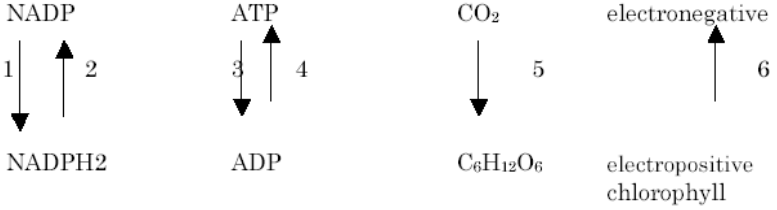
23. Only one of the following features of the phylum of the Chordata also is present in adult Tunicata (=Urochordata). Which feature?

[ ] A. possession of a chorda
[ ] B. possession of visceral slits (= pharyngeal slits)
[ ] C. possession of a tail
[ ] D. possession of a dorsal tubular nervous system

24. Which of the following is true for transport in xylem?

[ ] A. The primary force involved is osmotic pressure
[ ] B. Xylem is the primary site for transport of sucrose
[ ] C. Movement through xylem depends mainly on transpiration
[ ] D. All of the above

25. Which of the given actions are part of the light stage of photosynthesis?



[ ] A. 1, 3, 6
[ ] B. 1, 4, 6
[ ] C. 2, 3, 6
[ ] D. 2, 4, 5
[ ] E. 1, 3, 5

26. Animal behaviour patterns, in which an individual endangers its life to benefit other members of the group, are called altruistic. It is believed that altruistic behaviour was favoured by kin selection. Which if the examples given below CANNOT be explained as kin-selection-favoured?

[ ] A. suicidal attack by a worker bee guarding its hive
[ ] B. protection of the queen of an ant species by "soldier ants"
[ ] C. protection of lion cubs by a lioness NOT being their mother
[ ] D. warning cries of a bird warning other individuals about approaching danger

27. In a grazed field the net primary production is less than the gross primary production. Which of following could account for this difference?

1. Plants use energy in translocation.
2. Plants use energy in actively transporting ions across membranes.
3. Hydrolytic enzymes in plants use energy in breaking down food reserves.
4. Plants use energy when water vapour is lost via the stomata.
5. Grazing by herbivores.

[ ] A. 1 & 2
[ ] B. 2 & 3
[ ] C. 3 & 4
[ ] D. 1, 2 & 3
[ ] E. 2, 3 & 4

28. Which of the following hormones is most elevated after a large, carbohydrate-rich meal?

[ ] A. glucagon
[ ] B. glucose
[ ] C. GnRH
[ ] D. insulin

29. Which of the following animal taxa only occur in the sea?

1. starfish and sea urchins (*Stellaroidea, Echinoidea*)
2. jellyfish (*Cnidaria*)
3. sponges (*Porifera*)
4. squids (*Cephalopoda*)
5. highly developed crustacea (*Malacostraca – Crustacea, Astacus*)

[ ] A. 1 & 4
[ ] B. 2 & 3
[ ] C. only 5
[ ] D. 1, 2 & 3
[ ] E. 2, 4 & 5

30. How many different phenotypes can be expected in the F2 of the crossing: AA BB * aa bb when:

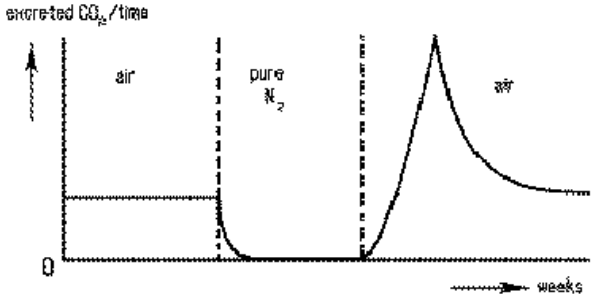
I the genes are completely coupled and,
II the genes inherit independently:

		I	II
[_]	A	3	4
[_]	B	3	9
[_]	C	4	9
[_]	D	4	16
[_]	E	9	16

31. Which hypothesis seeks to explain why a plant auxin produces different effects on the growth of a root and of a shoot?

[ ] A. Gravity affects the action of the auxin.
[ ] B. The growth rates of roots and shoots differ.
[ ] C. The auxin travels faster downwards towards the root.
[ ] D. The root and shoot respond differently to similar auxin concentrations.
[ ] E. Light affects the action of the auxin.

32. Potatoes are stored for one week in pure air, then for one week in pure nitrogen and then in pure air again. During the experiment the excretion of CO2 is measured. The diagram shows the results.



The extra amount of CO2 produced and excreted during the third week probably came from

[ ] A. ethanol
[ ] B. ethanal
[ ] C. lactic acid
[ ] D. $NADH_2$
[ ] E. $NADPH_2$

33. Who presented a manuscript of a theory of evolution identical to Darwin's one year before the publication of *The Origin of Species*?

[ ] A. Hutton
[ ] B. Gould
[ ] C. Malthus
[ ] D. Cuvier
[ ] E. Wallace

34. Generally, there are more species per square kilometer in which of the following types of ecosystem?

[ ] A. Temperate grassland
[ ] B. Arctic tundra
[ ] C. Boreal forest
[ ] D. Coral reef

35. Which of the following contribute to phenotypic variation in a population?

I. Mutations
II. Crossing over
III. Constancy of the environment
IV. Independent assortment.

[ ] A. I & II only
[ ] B. II & III only
[ ] C. III & IV only
[ ] D. I, II & IV

36. Which of the following is NOT a characteristic of all chordates?

[ ] A. vertebrae
[ ] B. notochord
[ ] C. pharyngeal slits
[ ] D. postanal tail

37. In a particular breed of cattle, the allele for the polled condition (no horns) is dominant to the horned condition. Coat colour is determined by another gene which has two alleles so that the animals can be homozygous red and homozygous white, whilst the heterozygous condition is called roan (red with white patches). A cross was made between a horned red cow and a horned white bull. Assuming that neither of these characteristics is sex-linked, which of the following statements about the offspring from this cross are true?

I. The offspring will show equal numbers of horned roan and polled roan individuals.
II. All offspring will be horned, but coat colour will have red, white and roan individuals.
III. All off spring will be homozygous for the horned condition and heterozygous for coat colour.
IV. All the offspring will be horned and roan
V. None of the offspring will be polled.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II & III
[ ] E. III, IV & V

38. The vitelline sac (=yolk sac) is expected to be very small in one of the following groups. In which one?

[ ] A. in groups that fertilize externally
[ ] B. in groups with embryos that are fed from maternal blood
[ ] C. in groups that fertilize internally
[ ] D. in groups that have an allantoic membrane

39. C4-plants can start photosynthesis with a lower concentration of CO2 in the atmosphere than C3-plants. This is because:

[ ] A. respiration of C4-plants is higher
[ ] B. respiration of C4-plants is lower
[ ] C. C4-plants do not have photorespiration
[ ] D. C4-plants do have photorespiration

40. Which one of the following is the site of the influx of sodium ions during the passage of an action potential along a myelinated axon?

[ ] A. the nodes of Ranvier
[ ] B. the whole of the axon membrane
[ ] C. the sodium pump area of the axon membrane
[ ] D. the chemical synapse
[ ] E. the myelin sheath

41. The transfer of energy through a terrestrial ecosystem is often depicted by energy pyramids. Which of the following statements is true ?

[ ] A. Ecological efficiency is highest for top consumers
[ ] B. About 10 % of the energy from one trophic level is incorporated into biomass of the next level
[ ] C. The energy lost as heat or in cellular respiration is 10 % of the available energy of each trophic level
[ ] D. Only 25 % of the energy in one trophic level is passed on to the next level

42. In many types of cancer, the function of the *p53* gene is lost. Wild-type *p53* is MOST likely to be a

[ ] A. proto-oncogene
[ ] B. tumor suppressor
[ ] C. positive regulator of cell cycle progression
[ ] D. gene required for DNA replication

43. Which of the following Mendelian laws does the concept of linkage violate?

[ ] A. independent assortment
[ ] B. segregation
[ ] C. non-random mating
[ ] D. None of the above

44. Which of the following molecules are involved in the production of protein in the cell?

I. Messenger RNA
II. Ribosomal RNA
III. Transfer RNA
IV. ATP
V. Amino acids

[ ] A. I, II, & III only
[ ] B. I, II, III & IV only
[ ] C. III, IV & V only
[ ] D. II, III, IV & V only
[ ] E. all of them

45. In the domestic cat, the autosomal locus White is dominant and epistatic; the locus Orange is sex linked with allele O tabby and allele o red, while the heterozygous is tortoise. A white female mates with a tabby tomcat. The kittens turn out to be:

1 red male
1 tortoise female
1 tabby female
1 white male
1 white female

What is the genotype of the mother?

[ ] A. WW Oo
[ ] B. Ww OO
[ ] C. Ww Oo
[ ] D. Ww oo

46. Consider a population in Hardy-Weinberg equilibrium. Which of the following assumptions must be met?

[ ] A. Non-random mating
[ ] B. Genetic mutation
[ ] C. Sexual selection
[ ] D. No natural selection

47. Under conditions of a high atmospheric humidity hardly any calcium (Ca) is transported to developing fruits. This is caused by:

[ ] A. calcium only being transported through the xylem and this transport not taking place anymore
[ ] B. calcium only being transported through the phloem and this transport not taking place anymore
[ ] C. transpiration stopping and, as a result both xylem and phloem transport stopping
[ ] D. the stomata closing and transport to the fruit stopping

48. Which of the following processes occur during the nitrogen cycle?

I. The oxidation of nitrites to nitrates by root nodule bacteria.
II. Consumption of plant protein by herbivores.
III. The conversion of dead organisms into ammonia by decomposers.
IV. Conversion of ammonium compounds into nitrates by denitrifying bacteria.
V. The oxidation of ammonium compounds into nitrites by nitrifying bacteria.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II, & III
[ ] E. II, III, & V

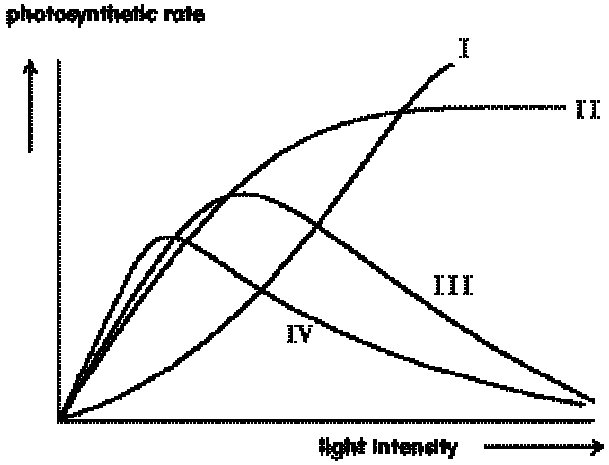
49. Suppose that the frequency of homozygous dominant genotype (AA) in a population obeying Hardy-Weinberg equilibrium is 0.25. What is the homozygous recessive (aa) genotype frequency?

[ ] A. 0.05
[ ] B. 0.10
[ ] C. 0.25
[ ] D. 0.50

50. Which one of the following substances provides electrons for the reduction reactions in photosynthesis?

[ ] A. NADP
[ ] B. Chlorophyll
[ ] C. Cytochrome
[ ] D. Water
[ ] E. ATP

51. Four types of Phytoplankton (I, II, II and IV) were collected from different depths of the sea. For each of these types, the photosynthesis was measured, as represented in the following figure. Which type of Phytoplankton was collected at the greatest depth?



[ ] A. I
[ ] B. II
[ ] C. III
[ ] D. IV

52. A bacterial mRNA with a length of 360 nucleotides codes for a protein of:
[ ] A. roughly 1080 amino acids
[ ] B. roughly 360 amino acids
[ ] C. between 120 – 360 amino acids
[ ] D. exactly 120 amino acids
[ ] E. less than 120 amino acids

53. Which of the following statements is/are correct?
I. penguins are an intermediate form between birds and mammals
II. penguins are densely covered with feathers
III. penguins are densely covered with hair
IV. penguins are densely covered with chitin fibres.

[ ] A. I, II
[ ] B. I, III
[ ] C. only II
[ ] D. only III
[ ] E. only IV

54. A new characteristic usually appears in evolution as a result of:
[ ] A. accumulation of point mutations in a gene which originally encoded for something else
[ ] B. duplication of a gene and accumulation of point mutations in one of the copies coming from that duplication
[ ] C. a mutation in a regulator gene
[ ] D. genotypical recording of favourable phenotypical adaptations

55. The mitochondrion takes in and releases a number of materials during aerobic respiration. Which of the following does it take in during daylight?

[ ] A.	ATP ;	$PO4^{2-}$;	O2 ;	pyruvate.
[ ] B.	ATP ;	$PO4^{2-}$;	CO2 ;	succinate.
[ ] C.	ADP ;	$PO4^{2-}$;	O2 ;	pyruvate.
[ ] D.	ADP ;	$PO4^{2+}$;	CO2 ;	lactate.
[ ] E.	ADP ;	$PO4^{2-}$;	O2 ;	lactate.

56. Which of the following cell types secrete antibodies?

[ ] A. B cell
[ ] B. Helper T cell
[ ] C. Cytotoxic T cell
[ ] D. Suppressor T cell

57. Which of the following is NOT a mode of natural selection?

[ ] E. stabilizing selection
[ ] F. directional selection
[ ] G. sexual selection
[ ] H. diversifying selection

58. Cells of the pancreas will incorporate radioactive amino acids into proteins. This labels newly synthesized proteins and enables to track the location of these proteins in a cell. In this case we are tracking an enzyme that is eventually secreted by pancreas cells. Which of the following is the most likely pathway for movement of this protein in the cell?

[ ] A. endoplasmic reticulum - Golgi --> nucleus
[ ] B. Golgi - endoplasmic reticulum --> lysosome
[ ] C. nucleus - endoplasmic reticulum --> Golgi
[ ] D. endoplasmic reticulum - Golgi --> vesicle that fuses with plasma membrane
[ ] E. endoplasmic reticulum -lysosome --> vesicles that fuses with plasma membrane

59. A *B*-lymphocyte produces and secretes antibodies. Which structures of its protoplast should therefore be well developed?

[ ] A. only the smooth endoplasmic reticulum
[ ] B. only the smooth endoplasmic reticulum and the Golgi apparatus
[ ] C. only the rough endoplasmic reticulum
[ ] D. only the rough endoplasmic reticulum and the Golgi apparatus
[ ] E. the rough endoplasmic reticulum, the Golgi apparatus and the lysosomes.

60. In superoxide dismutase 1, an enzyme implicated in amyotrophic lateral sclerosis (Lou Gehrig's disease), a copper ion is bound to the active site and is important for enzyme activity. In this enzyme, copper most likely functions as a(n)

[ ] A. coenzyme
[ ] B. allosteric activator
[ ] C. allosteric inhibitor
[ ] D. cofactor

61. The animals at the end of a food chain are generally few in number;
- **[ ] A.** Because they are always the largest organisms in the food chain.
- **[ ] B.** Because they have long gestation periods and few offspring.
- **[ ] C.** Because predators have high levels of intra-specific competition and infant mortality is high.
- **[ ] D.** Because of energy losses in the food chain there is insufficient energy to support large numbers of tertiary consumers.
- **[ ] E.** Because tertiary consumers have large territories.

62. The belonging of a human erythrocyte to serotypes A, B, 0 is determined by chemical markers on its surface. These markers are:
- **[ ] A.** lipid molecules
- **[ ] B.** oligosaccharides
- **[ ] C.** polypeptides
- **[ ] D.** antibodies
- **[ ] E.** nucleic acids

63. Nitrogen fertilization of rice fields can be low in the presence of one of the following types of organisms. Which one ?
- **[ ] A.** Water fern (*Azolla* species)
- **[ ] B.** Green algae
- **[ ] C.** Brown algae
- **[ ] D.** Mosses

64. The light reaction in photosynthesis can be made to occur experimentally in the absence of:
- **[ ] A.** water
- **[ ] B.** carbon dioxide
- **[ ] C.** chlorophyll
- **[ ] D.** ADP
- **[ ] E.** hydrogen carriers

65. Which of the following serves as the heart's primary pacemaker?
- **[ ] A.** SA node
- **[ ] B.** Bundle of His
- **[ ] C.** Purkinje fibers
- **[ ] D.** Vagus nerve

66. In the conversion of glucose to two molecules of pyruvate, which of the following occur?

I. Hydrolysis of ATP
II. Phosphorylation of hexose
III. Reduction of NAD
IV. Release of CO_2

- **[ ] A.** I & II
- **[ ] B.** II & III
- **[ ] C.** III & IV
- **[ ] D.** I, II & III
- **[ ] E.** II, III & IV

67. Telomerase is responsible for _____ the size of telomeres, and its function is often ____ in carcinogenesis.

[ ] A. maintaining ... increased
[ ] B. maintaining ... decreased
[ ] C. decreasing ... decreased
[ ] D. decreasing ... increased

68. The phylum Arthropoda includes which of the following classes?

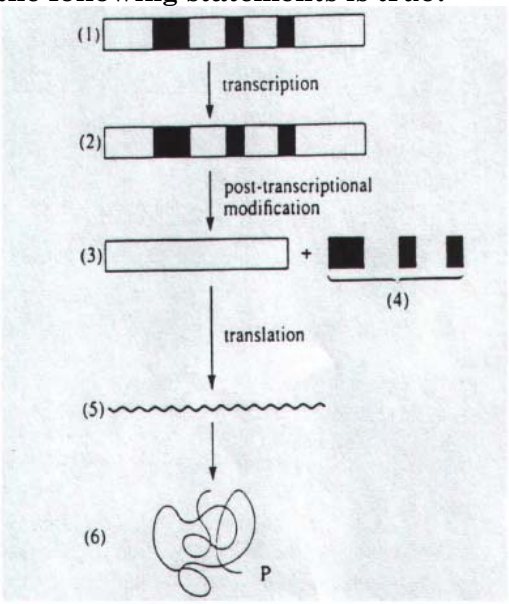
I. Crustacea.
II. Polychaeta.
III. Insecta.
IV. Arachnida.

[ ] A. I, II & III
[ ] B. I, III & IV
[ ] C. II, III, & IV
[ ] D. I, II & IV
[ ] E. All of them

69. The order of normal blood flow through the human heart is

[ ] A. right atrium, right ventricle, lungs, left atrium, left ventricle, body
[ ] B. right ventricle, right atrium, lungs, left ventricle, left atrium, body
[ ] C. right ventricle, right atrium, body, left ventricle, left atrium, lungs
[ ] D. right atrium, right ventricle, body, left atrium, left ventricle, lungs

70. A split gene consists of coding regions (exons) and non-coding regions (introns). The figure shows how such a gene leads to the production of protein P. Which of the following statements is true?



[ ] A. Thymine content of (1) and (2) is equal
[ ] B. The process occurring between (1) and (2) takes place in the cytosol.
[ ] C. (3) is functional mRNA.
[ ] D. The number of amino acid residues in (5) must equal the number of nucleotide residues in (2).
[ ] E. The process occurring between (3) and (5) takes place in nuclei.

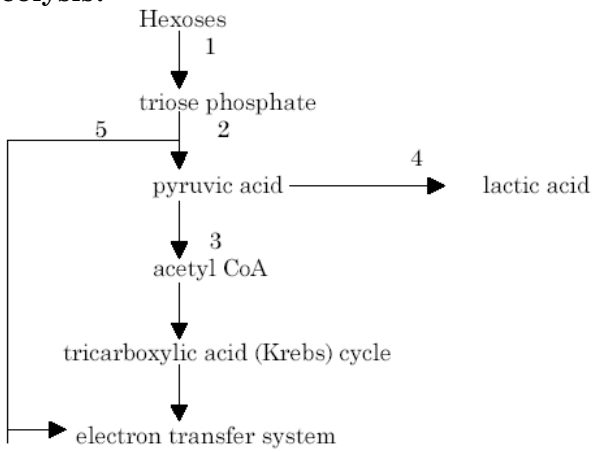
71. The promoter region of a prokaryotic gene is located _____ to the gene and is the binding site for _____.

[ ] A. 3'...DNA polymerase
[ ] B. 5'...RNA polymerase
[ ] C. 5'...DNA polymerase
[ ] D. 3'...RNA polymerase

72. An increased concentration of Na+ in the blood plasma would stimulate the secretion of which hormone?

[ ] A. FSH
[ ] B. ADH
[ ] C. GnRH
[ ] D. Aldosterone

73. The diagram below summarizes the stages involved in respiratory metabolism of mammalian skeletal muscle. Which one of the following shows the stages involved in glycolysis?



[ ] A. 1 & 2 only
[ ] B. 1, 2 & 3 only
[ ] C. 1, 2 & 4 only
[ ] D. 1, 2 & 5 only
[ ] E. 1, 2, 3 & 4

74. The concentration of an electrically neutral substance within a certain type of blood cell is much higher than it is in the surrounding blood plasma, yet the substance continues to move into the cell. The process by which this substance moves into the cell is called:

[ ] A. osmosis
[ ] B. simple diffusion
[ ] C. facilitated diffusion
[ ] D. active transport

75. Which of the following organisms is INCORRECTLY paired with its trophic level?

[ ] A. Human - tertiary consumer
[ ] B. Beetle - secondary consumer
[ ] C. Grass - primary producer
[ ] D. Cyanobacteria - primary producer

76. Which of the following organisms is used to transfer genes into higher plants?

[ ] A. Escherichia coli
[ ] B. Rhizobium trifolii
[ ] C. Agrobacterium tumefaciens
[ ] D. Salmonella typhimurium
[ ] E. Bacillus radicicola.

77. Which of the following ecological statements are true?

I. All tertiary consumers are predators.
II. Detritus is made from dead plants and animals.
III. Net primary productivity is always lower than gross primary productivity.
IV. Pyramids of energy can sometimes be inverted.
V. One animal can sometimes occupy more than one trophic level in a food web.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II & III
[ ] E. II, III & V

78. Animal and plant cells possess channels directly connecting the cytoplasm of one cell to the cytoplasm of another cell. Which of the following pairs allows this communication?

[ ] A. plasmodesmata, desmosomes
[ ] B. plasmodesmata, Ca^{2+}-ATPase
[ ] C. porin, gap junction
[ ] D. gap junction, plasmodesmata.

79. When a muscle cell has a shortage of oxygen will the pH decrease or increase? What substance is responsible for this change in pH? Change in pH caused by

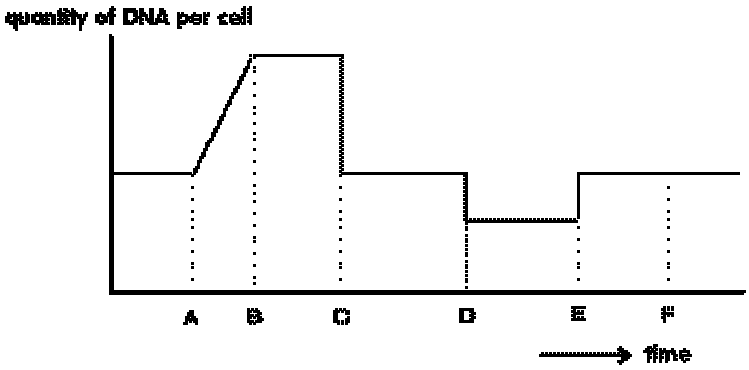
[ ] A. decrease lactate (lactic acid)
[ ] B. decrease carbon dioxide
[ ] C. increase lactate (lactic acid)
[ ] D. increase carbon dioxide

80. Standing crop is:

I. The number of plants growing in a particular habitat at a specific time of year
II. the number of stems still erect after a violent storm
III. not a good indicator of productivity
IV. the biomass of a known sample in a particular habitat at a specific time
V. not affected by seasonal variations in light and temperature.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II, & III
[ ] E. II, III & IV

81. What letter indicates the quantity of DNA per cell at the end of meiosis I (see figure)?



[ ] A. A
[ ] B. B
[ ] C. C
[ ] D. D
[ ] E. E

82. A husband and wife have a child with blood type AB. The wife is blood type O. What is the blood type of the husband?
[ ] A. A
[ ] B. B
[ ] C. AB
[ ] D. O

83. The main trend in the evolution of land plant was:
[ ] A. a sharp demarcation of the phases of sporophyte and gametophyte
[ ] B. a shortening of the haploid phase
[ ] C. a shortening of the a-sexual phase
[ ] D. an increase in the complexity of the gametophyte

84. Where does translation occur in a bacteria?
[ ] A. nucleus
[ ] B. endoplasmic reticulum
[ ] C. cytoplasm
[ ] D. Cell Membrane

85. Allopatric speciation refers to species formed after which type of separation:
[ ] A. niche
[ ] B. temporal
[ ] C. geographic
[ ] D. behavioral

86. A bacterial mRNA with a length of 360 nucleotides in length codes for a protein of:
[ ] A. roughly 360 amino acids
[ ] B. roughly 1080 amino acids
[ ] C. exactly 120 amino acids
[ ] D. less than 120 amino acids

87. Unlike most polypeptide hormones, steroid hormones are unique in that they

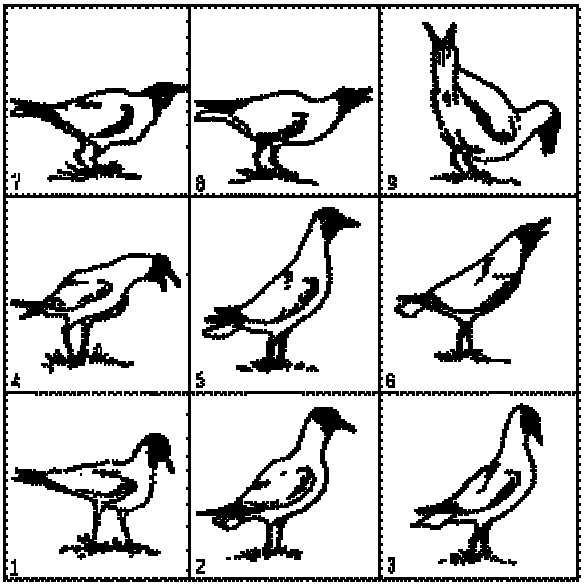
[ ] A. Activate gene transcription
[ ] B. Can bind proteins
[ ] C. Diffuse across cell membranes
[ ] D. Can be used as therapeutic drugs

88. When investigating enzyme/substrate interaction, which of the following would be expected to show a linear relationship under constant conditions?

I. rate of reaction against enzyme concentration in the presence of excess substrate.
II. rate of reaction against enzyme concentration with the amount of substrate limited
III. amount of product against time, with the amount of substrate limited
IV. rate of reaction against substrate concentration

[ ] A. I only
[ ] B. I & II
[ ] C. III only
[ ] D. II & IV
[ ] E. IV only

89. The figure shows possible positions of the black headed gull (*Larus melanocephalus*). A gull has landed by accident in the territory of another gull and both gulls meet each other. Which position will probably be shown by the visitor gull.



[ ] A. position 1
[ ] B. position 3
[ ] C. position 5
[ ] D. position 7
[ ] E. position 9

90. Which of the following molecules increases the blood's capacity to carry oxygen?

[ ] A. albumin
[ ] B. glucose
[ ] C. hemoglobin
[ ] D. fibrin

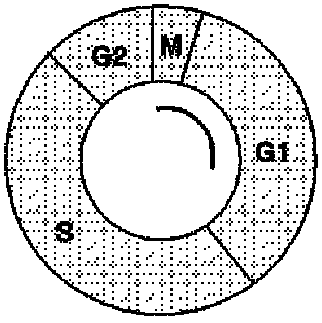
91. One pollen mother cell may produce four germinating pollen grains, each with two male nuclei and one tube nucleus. How many meiotic divisions are necessary to bring this about?

[ ] A. none
[ ] B. one
[ ] C. three
[ ] D. four
[ ] E. twelve

92. If an organism has K+ channels in its neuron that close faster than human K+ channels, which of the following periods would you expect to be decreased in this organism?

[ ] A. absolute refractory period
[ ] B. relative refractory period
[ ] C. extent of depolarization
[ ] D. None of the above

93. The picture shows a schematic drawing of the cell cycle. Somebody likes to determine the duration of the S-phase. This is done in adding a **with tritium labeled compound R to the medium of the organism with the dividing cells. Which of the following compounds is most suitable to be R?**



[ ] A. adenine
[ ] B. cytosine
[ ] C. guanine
[ ] D. thymine
[ ] E. ATP

94. The genotype of an organism:

[ ] A. Interacts with the environment to determine the phenotype
[ ] B. Is solely responsible for determining the phenotype
[ ] C. Is the sum of all the alleles carried on the autosomes
[ ] D. Includes only the dominant alleles which show in the phenotype
[ ] E. Is constant within a species.

95. What enzyme does HIV use to convert RNA to DNA?

[ ] A. DNA gyrase
[ ] B. RNA polymerase
[ ] C. DNA helicase
[ ] D. Reverse transcriptase

96. When a cell shows incipient plasmolysis:

[ ] A. the water potential will be at its least negative value
[ ] B. the pressure potential will be zero
[ ] C. the solute potential will be high and positive
[ ] D. the solute potential will be high and negative
[ ] E. the pressure potential will be high

97. Which group of plants has vascular tissue but does not produce seeds?

I. Mosses
II. Ferns
III. Gymnosperms

[ ] A. I
[ ] B. II
[ ] C. III
[ ] D. II & III

98. Xylem vessels carry liquid water from the roots of plants to the leaves, but in the process of transpiration it is water vapour which is lost through the stomata. The change of state from liquid to vapour occurs from the:

[ ] A. outer surface of the lower epidermis;
[ ] B. cellulose walls of the guard cells;
[ ] C. walls of the spongy mesophyll cells of the leaf;
[ ] D. lignified walls of the xylem vessels;
[ ] E. outer surface of the upper and lower epidermis.

99. The growth speed of a population can often be described with the logistic growth equation:

$$dN/dt = rN(K-N)/K$$

In this equation, N is the number of individuals, r is the intrinsic relative rate, and K is the carrying capacity. According to this equation, the equilibrium number of individuals in the population is determined by:

[ ] A. r only
[ ] B. K only
[ ] C. r and K
[ ] D. N and K
[ ] E. r and N

100. Where do beans (*Fabaceae*, e.g.soybean *Glycine max*, syn. *Soja hispida*) store reserve material for germination?

[ ] A. in the pericarp
[ ] B. in the cotyledons of the embryo
[ ] C. in the triploid nutritive tissue (endosperm) of the seed
[ ] D. in the diploid nutritive tissue (perisperm) of the seed
[ ] E. in the cotyledons and the endosperm.

101. A standard number of leaf discs of equal area were placed in sealed vessels containing bicarbonate indicator solution and kept in the dark for about 12 hours. The control vessel contained no leaf discs. All the vessels were then exposed to light at different intensities and, after 2 hours at 20° C, the following results were obtained.

Light intensity (arbitrary units)	Indicator colour		
	Species I	Species II	Control
2 500	purple	purple/red	red
1 500	purple	red	red
1 000	purple	red	red
500	purple	red	red
250	purple/red	red	red

The best conclusion from these data is that

[ ] A. species I is a sun plant and species II is a shade plant
[ ] B. species II is less efficient at photosynthesis than species I
[ ] C. the two species have different compensation points
[ ] D. species II has a higher respiration rate than species I
[ ] E. species I has a higher respiration rate than species II.

102. What name is given to the process by which a minimal number of stimuli from a presynaptic neurone are required to initiate an action potential in a postsynaptic neurone?

[ ] A. Excitation
[ ] B. Summation
[ ] C. Repolarisation
[ ] D. Depolarisation
[ ] E. Cumulative stimulation

103. The sight of cows grazing in a field is a common occurrence. Why is it, when a herd of cows grazes across a field, that they all face in the same direction? It is an example of:

[ ] A. territorial behaviour
[ ] B. trial and error learning
[ ] C. habituation
[ ] D. reaction to the prevailing wind conditions,
[ ] E. reducing head to head conflicts between dominant and subordinate animals

104. Respiratory alkalosis results from which of the following?

[ ] A. infrequent breathing
[ ] B. rapid breathing
[ ] C. large meals
[ ] D. None of the above

105. In angiosperms the pigment involved in detecting day length is:

[ ] A. carotene
[ ] B. chlorophyll
[ ] C. cytochrome
[ ] D. phytochrome
[ ] E. auxin

106. Which classes of lipids have non-polar side chains and polar head groups?

[ ] A. phospholipids
[ ] B. triglycerides
[ ] C. cholesterol
[ ] D. waxes
[ ] E. glycerol

107. The cell bodies of afferent (sensory) nerves involved in somatic reflexes are located in the

[ ] A. Dorsal root ganglion
[ ] B. Ventral root ganglion
[ ] C. Spinal nerve
[ ] D. Grey matter of spinal cord

108. Predation is considered a _____ interaction, while Mutualism is considered a _____ interaction.

[ ] A. +/+, +/+
[ ] B. +/-, +/+
[ ] C. +/0, -/-
[ ] D. -/-, +/+

109. Part of the TCA (Krebs) cycle is represented in the figure below. If the enzyme responsible for the conversion of succinic acid to fumaric acid became inactive, which of the following would occur?

α-ketoglutaric acid → succinic acid → fumaric acid → malic acid

I. some accumulation of succinic acid
II. continued conversion of □-ketoglutaric acid
III. gradual disappearance of fumaric acid
IV. an immediate halt in the production of malic acid

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II & III
[ ] E. II, III & IV

110. A mollusc sample is given to a biologist. After examining the sample he says that it belongs to Bivalvia. Which of the followings may be the key that makes him to reach this conclusion?

[ ] A. gills
[ ] B. absence of radula
[ ] C. body symmetry
[ ] D. mantle

111. Which component of skeletal muscle binds Ca^{2+} ions to initiate muscle contraction?
[ ] A. ATP
[ ] B. Myosin
[ ] C. Tropomyosin
[ ] D. Actin
[ ] E. Troponin

112. When a new male takes over a lion pride they sometimes kill or evict the cubs already present. This phenomena can be explained from behavioral ecology:
[ ] A. the male does not like cubs
[ ] B. the male cannot afford too much for caring those cubs
[ ] C. the male breed his own offspring
[ ] D. degeneration of the male's parental behavior

113. A culture of yeast cells growing vigorously in the absence of oxygen converts glucose to ethanol and carbon dioxide. Which of the following statements about this metabolic process are correct?
I. In this process, pyruvic acid is converted to acetyl coenzyme A.
II. The process involves decarboxylation.
III. The process produces less ATP than it uses.
IV. There is no net reduction of NAD.
V. Oxidations are involved, although the process is anaerobic.

[ ] A. I & III
[ ] B. II & V
[ ] C. III & IV
[ ] D. I & IV
[ ] E. II & IV

114. Integral transmembrane proteins are proteins imbedded in the cell membrane. Which of the following amino acids would you MOST expect to find in the transmembrane region of such proteins?
[ ] A. Tryptophan
[ ] B. Lysine
[ ] C. Serine
[ ] D. Arginine

115. Pavlov studied salivation in dogs in response to food. Dogs will normally produce saliva when they see, smell or taste food. Each time he fed the dogs he rang a bell. After five or six repetitions, the dog produced saliva on hearing the bell, even though it was not given food. This type of behaviour is called:
[ ] A. operant conditioning (trial and error learning)
[ ] B. classical conditioning
[ ] C. latent learning
[ ] D. imprinting

116. Age of some trees can be determined due to the presence of the "tree-rings" (annual growth rings), which represent the annual growth of:
[ ] A. primary phloem and xylem
[ ] B. secondary phloem and xylem
[ ] C. secondary phloem only
[ ] D. secondary xylem only

117. In the European population, about 1 in 2500 people suffers from Cystic Fibrosis, a genetically determined (descared), autosomal disease. Healthy parents have a child suffering from Cystic Fibrosis. The woman remarries a healthy man. What is the chance of a child from this second marriage suffering from Cystic Fibrosis:

[ ] A. 1 : 25
[ ] B. 1 : 50
[ ] C. 1 : 100
[ ] D. 1 : 625

118. When a muscle cell has a shortage of oxygen the pH changes. Which of the following is correct?

	pH change	**substance**
[_] A.	decrease	carbon dioxide
[_] B.	decrease	lactic acid
[_] C.	increase	carbon dioxide
[_] D.	increase	lactic acid
[_] E.	decrease	pyruvate

119. Ecological assemblies K through Q consist of species designated with numbers 1 through 8, present a various densities. Individual densities of these species in any particular assembly are given (as individuals per square meter) in the table. Which of the above assemblies is the least susceptible to a massive pest infection (gradation)?

assembly	[_] K	[_] L	[_] M	[_] N	[_] P	[_] Q
species 1	50	92	75	0	0	0
species 2	30	4	5	25	2	65
species 3	10	0	5	20	3	20
species 4	10	0	5	20	5	10
species 5	0	1	5	20	40	3
species 6	0	1	5	5	50	2
species 7	0	1	0	0	0	0
species 8	0	1	0	0	0	0

120. Which is TRUE of the dark reaction (Calvin cycle) of photosynthesis?

[ ] A. It uses oxygen
[ ] B. It produces sucrose
[ ] C. It uses carbon dioxide
[ ] D. Both b and c are correct

121. In chemiosmosis, hydrogen ions (protons) release their energy to produce ATP as they pass across the inner mitochondrial membrane. This process involves the use of :

[ ] A. ATP synthetase
[ ] B. ATP dehydrogenase
[ ] C. ATP decarboxylase
[ ] D. electron carriers
[ ] E. NAD

122. Females have two X chromosomes, but one is inactivated. What is the name for this inactivated X chromosome?

[ ] A. a Barr body
[ ] B. a repressed chromosome
[ ] C. a zygotic body
[ ] D. a silent chromosome

123. To reach the right hand, the blood from the stomach and intestines must pass through:

I. the heart (once)
II. the heart (twice)
III. carotid arteries
IV. the lungs
V. the liver
VI. the brain

[ ] A. I, IV, & V
[ ] B. I & IV
[ ] C. II, IV & V
[ ] D. II, IV & VI
[ ] E. III, IV & V

124. In cardiac muscle, calcium ions can move freely between adjacent cells through which of the following structures?

[ ] A. gap junctions
[ ] B. tight junctions
[ ] C. calcium pumps
[ ] D. plasmodesmata

125. Reflex actions play an important part in several types of innate behaviour, such as taxes and kineses. Which of the following correctly identifies the sequence of events in a simple reflex action?

[ ] A. receptor, brain, effector, response, stimulus
[ ] B. stimulus, brain, effector, receptor, response
[ ] C. stimulus, receptor, brain, effector, response
[ ] D. receptor, brain, stimulus, effector, response
[ ] E. stimulus, receptor, effector, brain, response

126. A mutation in a coding DNA sequence creates a premature stop codon. Which of the following could be a possible effect of this mutation on the polypeptide?

I. It no longer functions properly.
II. It is longer than expected.
III. It is not properly targeted to the correct region of the cell.

[ ] A. I only
[ ] B. II only
[ ] C. II and III only
[ ] D. I and III only

127. The velocity of action potential conduction across a nerve axon is increased by the presence of the myelin sheath. In the *peripheral nervous system*, what cell myelinates the axon?

[ ] A. Oligodendocyte
[ ] B. Astrocyte
[ ] C. Schwann cell
[ ] D. Microglial cell

128. Crossing-over occurs in what phase of meiosis?

[ ] A. Prophase I
[ ] B. Metaphase I
[ ] C. Telophase I
[ ] D. Metaphase II

129. Which of the following statements on introns is correct?

[ ] A. They are non-transcribed sequences (spacers) between two genes.
[ ] B. They are transcribed spacers between two genes.
[ ] C. They are located between the coding regions of a gene.
[ ] D. They are located between the coding regions of a mature mRNA
[ ] E. They are non-coding regions of a polycistronic mRNA

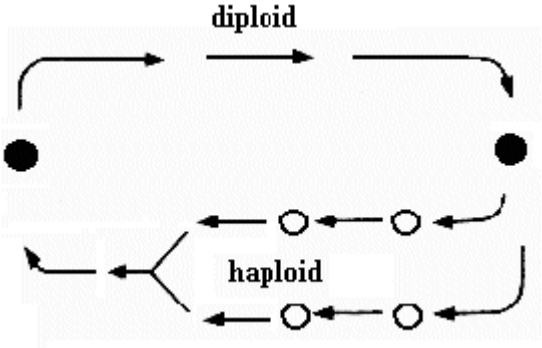
130. In the blood of an adult man the total content of haemoglobin is, roughly:

[ ] A. several hundred gram
[ ] B. tens of gram (10-100 g)
[ ] C. several gram
[ ] D. several hundred milligram
[ ] E. tens of milligram

131. The largest white blood cell in humans which is a part of the body's macrophage defence system is:

[ ] A. neutrophil
[ ] B. lymphocyte
[ ] C. monocyte
[ ] D. eosinophil
[ ] E. basophil

132. Reproduction is often connected with a shift from haploid to diploid or the other way round. Please review the diagram and decide with group of organisms shows the below mentioned type of shift.



[ ] A. humans
[ ] B. angiosperm plants
[ ] C. gymnosperm plants
[ ] D. ferns

133. Which of the following does NOT represent an alteration to a chromosome?

[ ] A. translocation
[ ] B. inversion
[ ] C. deletion
[ ] D. nondisjunction

134. Which of the following may pass across the mammalian placenta?

I. maternal antibodies
II. maternal lymphocytes
III. alcohol
IV. viruses
V. erythrocytes

[ ] A. I, II & III
[ ] B. II, III & IV
[ ] C. III, IV & V
[ ] D. I, IV & V
[ ] E. I, III & IV

135. Which phylum of invertebrates is characterised by pentamerous radial symmetry and possession of tube feet?

[ ] A. Mollusca
[ ] B. Arthropoda
[ ] C. Echinodermata
[ ] D. Annelida
[ ] E. Platyhelminthes

136. Which of the following alternatives is not an indication of annual photoperiodism?

[ ] A. swarming
[ ] B. moulting
[ ] C. flowering
[ ] D. sleep

137. Which of the following is TRUE of prokaryotes?

I. Simultaneous transcription and translation
II. Presence of intron sequences
III. Circular DNA

[ ] A. I and II only
[ ] B. I and III only
[ ] C. II and III only
[ ] D. I, II, and III

138. In a disputed paternity case, the following blood groups were identified:

Mother	Group A
Baby	Group O
Mr Rich	Group A
Mr Famous	Group B

Which of the following statements is true?

[ ] A. Both men could be the father (either man could be the father.)
[ ] B. Mr Rich cannot be the father.
[ ] C. Mr Famous cannot be the father.
[ ] D. Neither man could be the father.

139. In the fern life cycle, the dominant generation is the:

[ ] E. haploid gametophyte
[ ] F. diploid sporophyte
[ ] G. haploid sporophyte
[ ] H. diploid gametophyte

140. Which of the following statements about the work of Gregor Mendel are correct?

I. He concluded that the characteristics of an organism are determined by internal factors (genes) which occur in pairs.
II. He concluded that only one of a pair of factors can be represented in a single gamete.
III. He concluded that factors are linked if they occur on the same chromosome.
IV. He concluded that each member of a pair of factors can combine randomly with either member of another pair.
V. He concluded that independent segregation must occur during metaphase I of meiosis.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II & IV
[ ] E. II, III & V

141. Which of the following is not a part of the neuron?

[ ] A. dendrites
[ ] B. hillock
[ ] C. soma
[ ] D. sarcoplasmic reticulum

142. In rabbits, the dominant allele (B) codes for black body colour and the recessive allele (b) codes for white body colour. A cross between two rabbits produced 9 black and three white offspring. Which of the following statements about this cross are *most likely* to be correct?

I. This is a monohybrid cross showing sex linkage.
II. This is a monohybrid autosomal cross between two heterozygotes.
III. The male used in the cross was homozygous recessive.
IV. The genotypes of the offspring could include Bb, BB, and bb individuals.
V. The female used in this cross was homozygous dominant.

[ ] A. I & III
[ ] B. II & V
[ ] C. III & IV
[ ] D. I & IV
[ ] E. II & IV

143. When the base composition of DNA from bacterium *Mycobacterium tuberculosis* was determined, 18% of the bases were found to be adenine. What is the G + C content in *M. tuberculosis*?

[ ] A. 18%
[ ] B. 32%
[ ] C. 36%
[ ] D. 64%

144. Mesoderm tissue is absent in:

[ ] A. Cnidaria
[ ] B. Mollusca
[ ] C. Insecta
[ ] D. Echinodermata
[ ] E. Crustacea

145. By a suitable method of laboratory culture, a single cell taken from the interior of a leaf of a celery plant can be grown into another complete celery plant. Which two of the following statements about this procedure are correct?

I. In terms of the end product of growth, the single leaf cell is equivalent to a zygote.
II. Cells of the new plant are produced by a combination of mitotic and meiotic divisions.
III. Genes responsible for root development are absent from the single leaf cell.
IV. The phenotype of the two celery plants will be influenced by their environment.
V. This is a special form of cloning involving the use of reverse transcriptase and the replication of DNA by the conservative method.

[ ] A. I & II
[ ] B. II & V
[ ] C. III & IV
[ ] D. I & IV
[ ] E. II & IV

146. During human development, which process leads to the formation of three germ layers?

[ ] F. gastrulation
[ ] G. neurelation
[ ] H. morulation
[ ] I. cephalization

147. DNA synthesis on the lagging strand occurs by the end-to-end ligation of

[ ] A. Okasaki fragments
[ ] B. RNA primers
[ ] C. DNA topoisomerases
[ ] D. DNA polymerases

148. Nerve impulses can travel in both directions. These impulses are unidirectional along an axon because:

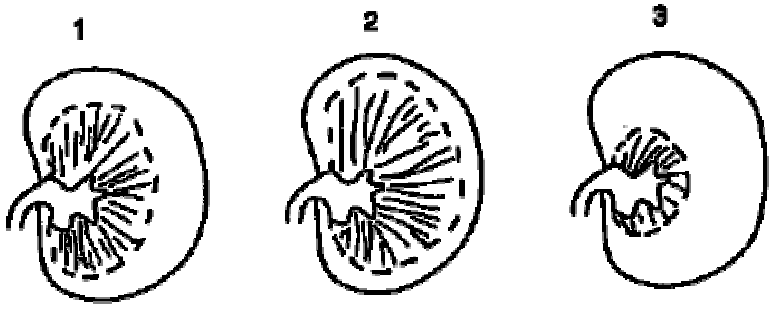
[ ] A. dendrites have a higher threshold than axons
[ ] B. the axon terminals have a higher threshold than axons
[ ] C. the myelin sheath directs the flow of ions toward the axon terminals
[ ] D. the axon terminals contain neurotransmitter receptors and the dendrites do not
[ ] E. dendrites do not contain neurotransmitter substance

149. Which of the following characterizes DNA synthesis on the leading strand?

I. It occurs from 5' to 3'
II. It requires RNA polymerase
III. The resulting DNA is complementary to the template

[ ] A. I only
[ ] B. II only
[ ] C. III only
[ ] D. I and III only

150. The diagrams show vertical sections of kidneys of coypu, brown rat and kangaroo rat, showing the relative size of cortex and medulla. Coypu are found in fresh water and are never short of water to drink. Brown rats are able to go some days without drinking. Kangaroo rats are able to live in deserts without drinking at all. Which kidney belongs to which animal?



	1	2	3
[_] A.	brown rat	coypu	kangaroo rat
[_] B.	brown rat	kangaroo rat	coypu
[_] C.	kangaroo rat	brown rat	coypu
[_] D.	kangaroo rat	coypu	brown rat

151. Oxygen content reduction makes the glycolyse (glycogenesis) intensity increased due to:

[ ] A. increase of ADP concentration in cell
[ ] B. increase of NAD+ concentration in cell
[ ] C. increase of ATP concentration in cell
[ ] D. increase of concentration of peroxides and free radicals

152. Protostomes have _____ and _____ types of cleavage.

[ ] A. radial ... indeterminate
[ ] B. radial ... determinate
[ ] C. spiral ... indeterminate
[ ] D. spiral ... determinate

153. In cats, the gene for coat colour is found on the non-homologous part of the X chromosome. The gene has two alleles; B gives black coat, b gives yellow coat and Bb produces a mottled colour called tortoiseshell. In cats, females are homogametic (XX) and males are heterogametic (XY). A cross was carried out between a female tortoiseshell and a black male. Which of the following statements *could* be true about this cross?

I. There is no chance of producing black male offspring.
II. All females will be black.
III Males could be black or yellow.
IV. Females could be black or tortoiseshell.
V. There is no chance of producing yellow male offspring.

[ ] A. I & II
[ ] B. II & III
[ ] C. III & IV
[ ] D. I, II & III
[ ] E. II, III & V

154. The ecosystems shown in the table differ in the amount of their net primary production. Select the correct order (increasing net primary production) of the ecosystems shown in the table.

number	ecosystem
1	tropical rain forest
2	savannah
3	subtropical sand desert
4	temperate deciduous forest
5	boreal deciduous forest
6	tundra

[ ] A. 3, 6, 2, 5, 4, 1
[ ] B. 3, 6, 5, 2, 4, 1
[ ] C. 6, 3, 5, 2, 4, 1
[ ] D. 6, 3, 2, 5, 1, 4

155. One of the alternatives below defines the layers of the retina in the correct sequence. Which one? (N.B! The first layer in each sequence is supposed to be located next to the jellylike vitreous humor that fills the eyeball.)

[ ] A. pigmented cells-bipolar cells-ganglion cells-photoreceptors
[ ] B. photoreceptors-pigmented cells-ganglion cells-bipolar cells
[ ] C. ganglion cells-bipolar cells-photoreceptors-pigmented cells
[ ] D. photoreceptors-bipolar cells-ganglion cells-pigmented cells

156. If the operator of a gene regulated in the same manner as the *lac* operon is mutated, what would you expect = would happen to the level of expression of the gene?

[ ] A. It would increase, because the repressor cannot bind the mutant operator as tightly.
[ ] B. It would increase, because the operator becomes a stronger promoter.
[ ] C. It would decrease, because the activator cannot bind the operator as tightly.
[ ] D. It would decrease, because the operator is not as strong a promoter.

157. The increase in complexity of the vertebrate circulatory system is represented by one of the following combinations. Which combination?

[ ] A. toad-rabbit-alligator-shark
[ ] B. shark-frog-alligator-rabbit
[ ] C. shark-crocodile-rabbit-frog
[ ] D. alligator-dog-shark-toad

158. Suppose gene "C" is the gene for color. Its dominant allele has the effect of allowing the production of fur color while its recessive allele interrupts color production. At another locus, there exists another gene that influences color, at which black (B) is dominant to brown (b). What is the relationship between these genes called?

[ ] A. Epistatic
[ ] B. Peralogous
[ ] C. Dominant
[ ] D. Antagonistic

159. A heron standing in a cold water for a long time doesn't get its legs overchilled because of:

[ ] A. countercirculation in limbs
[ ] B. even thin fat layer under limbs'skin
[ ] C. branched blood stream in limbs
[ ] D. intensive metabolism in limbs

160. Which of the following definitions of the uses of field equipment are correct? During field work an ecologist might use:

I. an auger to collect soil samples
II. a dendrograph to measure the diameter of a tree
III. a key to identify specimens
IV. a clinometer to measure slope

[ ] A. I & II only
[ ] B. II & III only
[ ] C. III & IV only
[ ] D. I, II & III
[ ] E. All of the above