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Theoretical Test - Part A

Cell Biology

A 1. The genetic code is:

- A. the set of cellular genes.
- B. the nucleotidic sequence of the gene.
- C. the genetic expression.
- D. the law of correspondence between ribonucleotide sequences and amino acids.

A 2. During differentiation:

- A. cells lose a substantial part of their genetic information.
- B. each cell of a multicellular organism expresses only one gene at a time.
- C. different strains of prokaryotes can be produced.
- D. only part of the genes of a given cell are active at the same time.

A 3. During meiosis:

- A. tetrads are formed at metaphase II.
- B. crossing over occurs at prophase I.
- C. homologous chromosomes are pairing during prophase II.
- D. sister chromatids are separated at anaphase I.

A 4. A given biochemical reaction:

- A. always loses energy.
- B. always receives energy.
- C. transmits energy to any other reaction or receives energy from any other reaction.
- D. transmits energy to another specific reaction or receives energy from another specific reaction.

A 5. The study of crossing over frequency between linked genes has been used:

- A. to estimate the efficiency of chromosome separation at anaphase.
- B. to estimate the physical distance between genes.
- C. to establish the genetic map of the chromosome.
- D. to estimate the frequency of a mutation.

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A 6. Thinking about cellular respiration, which of the following statements is correct?

Dinitrophenol (DNP) rapidly kills a cell because:

- A. it destroys and paralyses all the cell proteins.
- B. it forbids the access of the oxygen to the cell.
- C. it forbids the transport of cellular molecules transporting energy.
- D. it increases the oxygen consumption of the cell.

A 7. Under how many forms can a 2000 nucleotides gene exist?

- A. 1.
- B. 2000.
- C. 700.
- D. a practically illimited number.

A 8. ATP is an important molecule in metabolism because:

- A. it has high-energy phosphate bonds.
- B. its phosphate bonds are very easily formed but not easily broken.
- C. it is readily obtained from an organism's environment.
- D. it is extremely stable.

A 9. Which cell type would probably provide the best opportunity to study lysosomes?

- A. muscle cell.
- B. nerve cell.
- C. phagocytic white blood cell.
- D. leaf cell of a plant.

A 10. Large numbers of ribosomes are observed in cells that specialise in the production of:

- A. lipids.
- B. polysaccharides.
- C. proteins.
- D. glucose.

A 11. A biologist ground up a piece of plant tissue and then centrifuged the mixture. She obtained some organelles from the sediment in the test tube. The organelles took up CO₂ and gave off O₂. The organelles were most likely:

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- A. chloroplasts.
- B. ribosomes.
- C. nuclei.
- D. mitochondria.

A 12. Which one of the following cell structures doesn't contain nucleic acid:

- A. mitochondria.
- B. nucleus.
- C. rough endoplasmic reticulum.
- D. smooth endoplasmic reticulum.

A 13. Which is the correct series of histones forming the core of a nucleosome?

- A. H1 , H3 and H4.
- B. H2A , H2B ,H3 , H4.
- C. H1 , H2A and H2B.
- D. H1 , H2A , H2B and H4.

A 14. How does cyanide (CN⁻) cause the death of living things?

- A. by stopping photosynthesis.
- B. by breaking down protein molecules.
- C. by stopping (-oxidation).
- D. by stopping the electron flow through ETS enzymes.

A 15. Which of the following phenomena is responsible for arteriosclerosis?

- A. non modification of LDL receptors.
- B. joining of LDL complex and LDL receptors.
- C. shape modification of the active site of LDL complex.
- D. high concentration of cholesterol.

A 16. Which of the following experimental observation(s) support(s) the chemiosmotic theory about oxidative phosphorylation?

I- During electron transport, a proton gradient develops across the inner membrane of mitochondria.

II- A closed membrane or vesicular structure is required for oxidative phosphorylation.

III- ATP synthesis starts when a proton gradient develops in mitochondria.

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- A. only II.
- B. only III.
- C. only I and II.
- D. I, II and III.

A 17. The oxygen atoms used to form H₂O at the end of the oxidative phosphorylation chain (also named: terminal oxidation), come from:

- A. carbon dioxide.
- B. glucose.
- C. molecular oxygen.
- D. pyruvate.

A 18. Pyruvate is the end product of glycolysis. Consequently, which of the statements below is true?

- A. there is more energy in 6 molecules of carbon dioxide than in two molecules of pyruvate.
- B. there is less energy in two molecules of pyruvate than in one molecule of glucose.
- C. pyruvate is a more oxidized state than carbon dioxide.
- D. there is more energy in 6 molecules of carbon dioxide than in one molecule of glucose.

A 19. During aerobic respiration, electrons travel “downhill” from

- A. food → Krebs cycle → ATP → NAD⁺.
- B. food → NADH → electron transport chain → oxygen.
- C. glucose → ATP → oxygen.
- D. food → glycolysis → Krebs cycle → NADH → ATP.

A 20. You eat a nice portion of Belgian fries (fried potatoes) with chicken meat and a fresh salad. Which of the following molecules of this meal would normally not be oxidized in aerobic respiration to generate ATP?

- A. polysaccharides.
- B. proteins.
- C. nucleic acids.
- D. lipids.

A 21. In plant cells, ATP is produced in response to light. The electron transport chain that is involved in the process is located in the:

- A. thylakoid membranes of chloroplasts.
- B. stroma of chloroplasts.

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- C. inner membrane of mitochondria.
- D. cytoplasm.

A 22. The substance that is the general biosynthetic precursor of sex hormones and hormones of the adrenal cortex is:

- A. inositol.
- B. lecithin.
- C. phosphatidyl-choline.
- D. cholesterol.

A 23. During replication, the excision of the primers:

- A. is made by a DNase.
- B. produces OKAZAKI fragments.
- C. occurs only in the lagging strands.
- D. occurs in the nucleus.

A 24. The following substances are proteins of the cytoskeleton:

- A. actin, actinomycin, myosin.
- B. desmin, tubulin, dynein.
- C. tubulin, desmin, vinblastin.
- D. cytochalasin, actin, myosin.

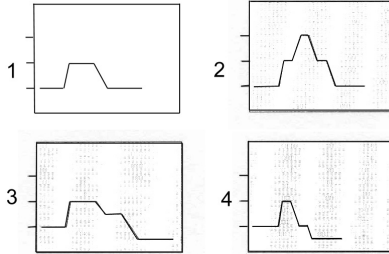
A 25. Two bottles of liquid were labelled X and Y. The two bottles contained different 0,2 molar (hypotonic) solutions. Red blood cells in a drop of blood were placed in each bottle. The cells in X swelled and some of them burst while those in Y shrunk and became shrivelled. On the basis of this information which of the following conclusions is most valid?

- A. the concentration of the solute in liquid X was higher than in the red blood cells
- B. the concentration of the solute in liquid Y was higher than in the red blood cells.
- C. the ionization of the solute was responsible for the shrinking of the red blood corpuscles in liquid Y.
- D. the diffusion of solute into the red blood corpuscles was responsible for the shrinking of the red blood corpuscles in liquid Y.

A 26. The diagrams below refer to variation in the amount of DNA (y axis) as a function of time (x axis) during cell division. (the units are arbitrary). Which ones of these diagrams depict what happens during meiosis and mitosis, respectively?

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- A. 1 and 2.
- B. 4 and 1.
- C. 3 and 4.
- D. 2 and 3.



A 27. The following short DNA sequence 5' AGGATGCTA 3' can be perfectly hybridized with:

- A. 5' AGGATGCTA 3'.
- B. 5' UGGUACGAU 3'.
- C. 5' ATCGTAGGA 3'.
- D. 5' TAGCATCCT 3'.

A 28. The following sequence is registered in a genomic data bank as part of a coding locus in a genome:
5'.....AGGAGGTAGCACCTTTATGGGGAATGCATTAACA.....3'.

The ATG underlined represents the initiation codon of the gene located at that locus. Among the following sequences, which one could be part of the transcribed mRNA corresponding to that locus?

- A. 5' AGGAGGUAGCACCUUUAUGGGGAAUGCAUUAACA 3'.
- B. 5' UCCUCCAUCGUGGAAAUACCCCUACGUAUUUGU 3'.
- C. 5' ACAAAUACGUAAGGGGUUUUCCACGAUGGAGGA 3'.
- D. 5' UGUUUAAUGCAUUCCCCAUAAAGGUGCUACCUCCU 3'.

A 29. In eucaryotic cells the sequence of organelles involved in the synthesis and secretion of a protein, is:

- A. ribosome, endoplasmic reticulum, Golgi, cell membrane.
- B. ribosome, Golgi, endoplasmic reticulum, cell membrane.
- C. mitochondrion, ribosome, endoplasmic reticulum, cell membrane.
- D. nucleus, mitochondrion, ribosome, Golgi, cell membrane.

A 30. If you extract the DNA of the bacteriophage (X174, you will find that its composition is 25 % A, 33 % T, 24 % G, and 18 % C. How would you interpret these results?

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- A. the experiment's results must be erroneous; something went wrong.
- B. we could admit that the A percentage approximately equals that of T, and the same for C and G. Consequently, Chargaff's rules are not eluded, DNA is double stranded and replicates semi-conservative.
- C. as the A and T, respectively C and G percentages are different, DNA is single - stranded; it is replicated by special enzymes, following a particular replication pattern, with single - stranded chain as a template.
- D. because A does not equal T, nor does G equal C, the DNA must be single - stranded; it replicates by synthesising a complementary strand and uses this double stranded form as a template.

A 31. DELETED

A 32. In the nucleus of a eukaryotic cell

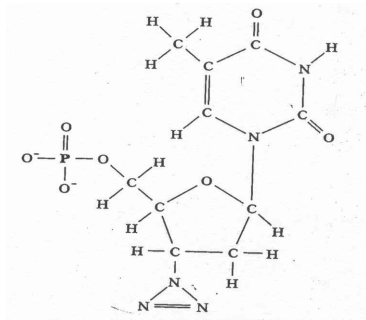
- A. more than 50 % of DNA codes for proteins.
- B. all the proteins are histones.
- C. transcription of DNA takes place only in the heterochromatin.
- D. nucleolar DNA codes for the synthesis of ribosomal RNA.

A 33. During protein synthesis,

- A. aminoacyl tRNA synthetase is involved in the synthesis of the amino-acids.
- B. the C-C-A end of tRNAs is used to attach the transfer RNAs to the mRNA.
- C. each new amino acid added to the system locks first in the A site of the large ribosomal subunit.
- D. peptidyltransferase moves the newly formed peptide from site A to site P.

A 34. The drug, AZT, is given to AIDS patients to slow down the progress of the disease. The structure of the drug is given here. The drug is effective as it:

- A. targets the HIV envelope proteins which prevents CD4 binding.
- B. inhibits DNA replication of HIV.
- C. binds to metabolic enzymes of the virus.
- D. interferes with the protease activity of HIV.



A 35. If the steps by which a virion is replicated are designated as follows:

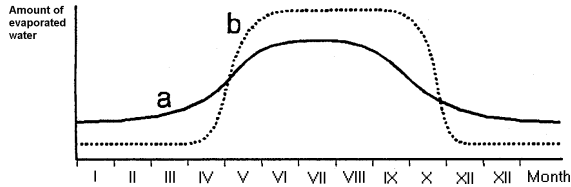
1. Synthesis of viral protein
2. Fusion of virion envelope with cell membrane
3. Assembly of proteins
4. Removal of capsid
5. Release of virus from cell
6. Replication of viral RNA,

Which of the following sequences is the correct one?

- A. 4-2-1-6-3-5.
- B. 6-4-1-3-5-2.
- C. 2-6-4-5-1-3.
- D. 2-4-6-1-3-5.

Plant anatomy and physiology

A 36. Graph demonstrates the amount of evaporated water during the year in two equally high trees growing in the same habitat in Belgium. To which tree species belong the two given curves in the graph?



- A. a) pine (*Pinus*), b) spruce (*Picea*).
- B. a) oak (*Quercus*), b) birch (*Betula*).
- C. a) pine (*Pinus*), b) oak (*Quercus*).
- D. a) oak (*Quercus*), b) spruce (*Picea*).

A 37. What is the number of chromosomes of the primary endosperm in the seed of *Pinus*?

- A. haploid.
- B. diploid.
- C. triploid.
- D. polyploid.

A 38. DELETED

A 39. DELETED

A 40. The changes (colour, texture and chemical composition) that take place in the fruits when they ripen are due to:

- A. the CO₂ content in the atmosphere.
- B. the temperature variation.
- C. the ethylen synthesis in the plant.
- D. the indolacetic concentration in the fruit.

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A 41. *Pinus* pollen is moved from male to female cones by:

- A. wind.
- B. water.
- C. insects.
- D. birds.

A 42. Which of the following statements about fungi is true?

- A. ascospores are formed asexually.
- B. gills of mushrooms are diploid.
- C. mycelia of nearly all fungi are predominantly dikaryotic.
- D. in the dikaryotic condition two unfused nuclei lie within the same cell.

A 43. How have bryophytes managed to survive on land?

- A. they were the first plants that developed stomata.
- B. they do not require moist environments for their reproductive cycles.
- C. they grow close to the ground in relatively moist regions.
- D. the sporophyte became independent of the gametophyte.

A 44. The gemmae of *Marchantia* are homologous to:

- A. seeds.
- B. gametes.
- C. asexual cells.
- D. pollen grains.

A 45. Which of the following is not an essential mineral element for plants?

- A. potassium.
- B. magnesium.
- C. calcium.
- D. lead.

A 46. Nitrate reduction:

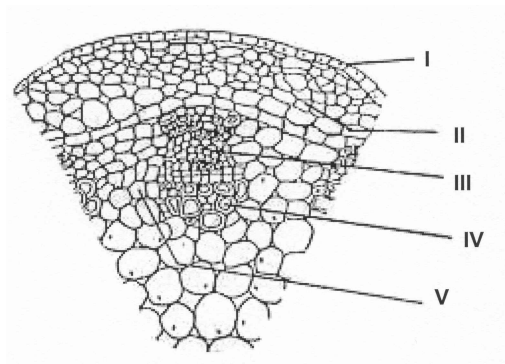
- A. is performed by plants.
- B. takes place in mitochondria.
- C. is catalyzed by the enzyme nitrogenase.
- D. is known as the nitrogen fixation process.

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A 47. In C_4 plant photosynthesis

- A. 3 PG (phosphoglyceraldehyde) is the first product of CO_2 fixation.
- B. four-carbon acid are formed by PEP (phosphoenolpyruvate) carboxylase in the bundle sheath.
- C. continues at lower CO_2 level than in C_3 plants.
- D. CO_2 released from RuDP (ribulose diphosphate) is transferred to PEP.

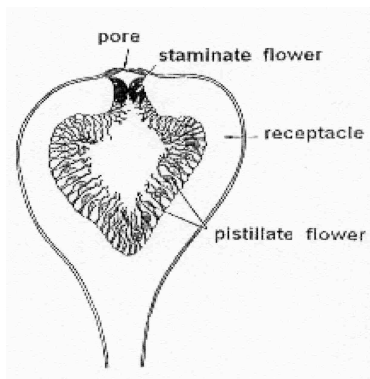
A 48. The diagram below shows a cut across a portion of a green non woody stem with a vascular bundle. It may be reasonably concluded that:



- A. starch would be found in the cells of area III.
- B. area II differentiated from protoderm.
- C. area IV was stained red of safranin.
- D. area V was interfascicular cambium.

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A 49. The diagram below is a longitudinal section of a flowering plant. What is the type of pollination?



- A. self-pollination by pollen from staminate flower to pistillate flower of the same flower.
- B. transfer of pollen from staminate flower to pistillate flower of other flowers on the same plant.
- C. wind-pollination.
- D. insect-pollination.

A 50. Two similar plants of a species of angiosperm grew under different amount of sunlight.

Plant I received full sunlight. Plant II received only seven percent sunlight. Both plants were grown in the same type of soil, and received equal amounts of water and the necessary mineral ions. At the end of the experiment, transverse sections were prepared from the leaves of each plant and examined under a microscope. The features seen in a typical section for each plant are illustrated below.

It is reasonable to suggest that:

- A. the rate of photosynthesis of plant I is less than the rate of respiration for plant II.
- B. the rate of respiration of plant I is less than the rate of respiration for plant II.
- C. the rate of photosynthesis of plant II is equal to the rate of respiration.
- D. the high concentration of light intensity decreases cellular respiration of plant I.

A 51. DELETED

A 52. The difference between cyanobacteria (blue-green algae) and the other algae groups (red, brown and green algae) is marked by the fact that:

- A. cyanobacteria are only found in marine habitats.
- B. cyanobacteria always have flagella.
- C. cyanobacteria never are diploid.
- D. cyanobacteria always use H₂S for their photosynthesis.

A 53. Diatoms (Bacillariophyta) can reproduce asexually through the process of template formation of silica-plate boxes (epitheca - hypotheca). As a result, most of the newly formed boxes will decrease in size and ultimately lead to unviable small cell sizes. This problem is avoided:

- A. through the fact that during sexual reproduction the zygote will increase in size before formation of new silica plates.
- B. through conjugation (fusion of the content of two small cells into one large cell).
- C. through the fusion of two small silica plates into one larger silica plate.
- D. through the fusion of four small silica plates into one larger silica plate.

A 54. Where does the embryo in flowering plants gets its energy from?

- A. the haploid endosperm.
- B. the tapetum layer.
- C. the light that penetrates through the seed coat.
- D. the albumen (triploid endosperm).

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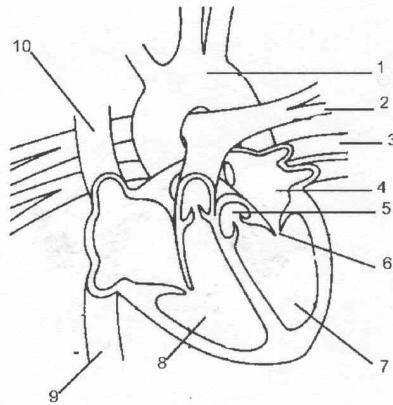
Animal anatomy and physiology

A 55. In fishes, auditory sensitivity rests on groups of ciliated cells of the labyrinth wall called neuromasts and attached to a heavy mass (CaCO_3 grains or a sort of stone, called otoliths). Neuromasts register movements of the otoliths relative to the labyrinth wall. Underwater sounds are transmitted in the form of pressure waves that do not result in important water molecules displacements. Selachian Sandry otoliths are less efficient than Teleostean ones, which consist in little stones. Choose the group of fishes provided with the best auditory device:

- A. no particular group.
- B. teleosts which possess a gas bladder.
- C. fishes swimming near the surface of seas and lakes.
- D. skates.

A 56. Here is a diagram of the mammalian heart. Through which of the following does oxygenated blood enter the heart?

- A. 1.
- B. 2.
- C. 3.
- D. 10.



A 57. Which of the following statements is correct?

- A. all veins carry blood flowing to the heart.
- B. all veins carry oxygenated blood.
- C. all veins carry deoxygenated blood.
- D. arteries are larger than their corresponding veins.

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A 58. The taste quality detected by taste buds located on the posterior third of the tongue is:

- A. sweet.
- B. acid.
- C. hot.
- D. bitter.

A 59. Erythrocytes of man with blood group A are mixed with blood plasma of another man. No agglutination is observed. It can be concluded that the blood group of the plasma donor is:

- A. only B.
- B. A or O.
- C. A or AB.
- D. A, B or O.

A 60. The use of stimulant drugs, as cocaine or amphetamine, evokes, among other effects, a state of intense nervous excitation. Which one of the following sentences related to these drugs **could not** explain their effect?

- A. their structure is such that they link to the CNS dopamin receptors.
- B. they are less efficiently metabolized by the organism, than the neurotransmitter they mimic.
- C. they contain an amino group, just as dopamine and adrenaline.
- D. their affinity for dopamine receptors is superior to that of the natural neurotransmitter.

A 61. To elevate the level of circulating lactate dehydrogenase (an enzyme) in a rabbit, a scientist injects a solution of sodium lactate. One hour later he measures the actual lactate dehydrogenase activity in the muscles. Which physiological mechanism does he challenge in this experiment?

- A. positive feed-back.
- B. negative feed-back.
- C. detoxification.
- D. gene induction.

A 62. Essential oils from such aromatic plants as nutmeg contain large amounts of aromatic hydrocarbons which, upon simple addition of an amino

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group, yield amphetamine derivatives with hallucinogenic properties. This reaction has been accomplished *in vitro* with cellular homogenates converting a fraction of these essential oils to sympathomimetic compounds. The ingestion of large quantities of powdered nutmeg leads to an intoxication state reminding the amphetamine's effects, indicating that some conversion also occurs *in vivo*.

a) Which of the following enzymatic systems could be responsible for this?

- A. oxydoreductases.
- B. hydrolases.
- C. transaminases.
- D. kinases.

b) Where does this enzymatic activity mainly take place?

- A. in the liver.
- B. in the brain.
- C. in the lung.
- D. in the kidney.

A 63. In fish, inhibition of the ejection of the second polar body can be achieved by the application of a physical shock (pressure, temperature) at a precisely determined moment after fertilisation. The resulting embryos have two sets of DNA from the mother, and one from the father, and thus are triploid.

a). These individuals are sterile because,

- A. they have an odd chromosome number.
- B. their sexual organs grow abnormally.
- C. the spermatozoa are too big, and can't pass through the micropyle.
- D. triploid individuals have an abnormal behaviour, and their aggressiveness doesn't allow the necessary proximity during mating.

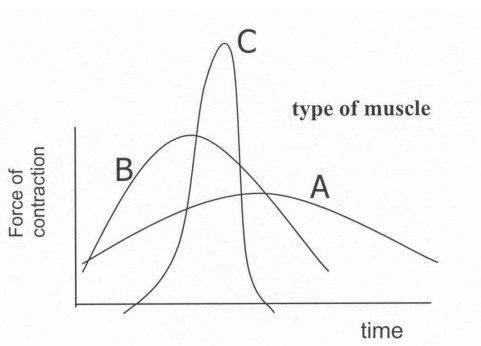
b). Which mechanism does explain the effect (non-ejection) of the physical shock on the second polar body?

- A. cytoskeleton desorganisation.
- B. the denaturing of some enzymatic systems.
- C. plasmic membrane rigidification.
- D. disintegration of the polar body inside the oocyte cytoplasm.

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A 64. The graph below represents the contraction patterns for three different kinds of muscles. Please match the correct sequence of patterns for smooth muscle, skeletal muscle and cardiac muscle respectively:

- A. BAC.
- B. CBA.
- C. ABC.
- D. ACB.



A 65. In an experiment designed to find what proportion of cabbage leaf material eaten by a caterpillar was converted into caterpillar biomass, it was observed that the caterpillar ate 2 cm^2 of leaf per day. In order to make an estimate of the conversion the following measurements were taken:

- W. average dry weight / cm^2 of leaf similar to that eaten.
- X. total weight of caterpillar faeces per day.
- Y. dry weight of caterpillar faeces per day.
- Z. weight of carbon dioxide produced per day.

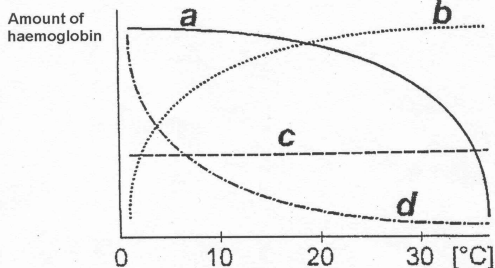
Which of the following formulae would be the appropriate one to estimate the weight of cabbage leaf converted into caterpillar biomass?

- A. $W - X - Z$.
- B. $W - Y - Z$.
- C. $2W - X - \text{carbon content of } Z$.
- D. $W + X - Y$.

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A 66. The amount of dissolved oxygen in water changes when its temperature increases. The amount of haemoglobin in body liquids of aquatic vertebrates depends therefore also on the temperature of water in which animals live. Which of the curves of the graph describes these changes best?

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



A 67. Oxygen release from hemoglobin is caused and enhanced by:

- A. low pO_2 , low pH and low temperature in the tissues.
- B. high pO_2 , high pH and high temperature in the tissues.
- C. high pO_2 , low pH and low temperature in the tissues.
- D. low pO_2 , low pH and high temperature in the tissues.

A 68. When a person suffers severe trauma, such as a broken leg, which hormone mobilizes aminoacids, sugar and fats to be used in the long-term stress response?

- A. acetylcholine.
- B. cortisol.
- C. aldosterone.
- D. adrenalin.

A 69. DELETED

A 70. Of the following anatomical structures, which one is homologous to the wing of a bat?

- A. the dorsal fin of a shark.
- B. the arm of a human.
- C. the pelvic fin of a fish.
- D. the wing of a butterfly.

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A 71. The plant-louse of oak trees is a small insect, stinging with its mouth parts into young branches and living on the sucked up liquid. How far do these lice sting into the branches?

- A. into vessel areas outside from the cambium.
- B. into the cambium.
- C. they sting into the different areas depending on the tree's age.
- D. the area depends on the louse's age and stage of development.

A 72. Which of these statements about reproduction in invertebrates is NOT correct?

- A. many invertebrates have separated sexes.
- B. many invertebrates utilise external fertilisation.
- C. some invertebrates have structures that store sperm.
- D. invertebrates do not engage in copulation.



Co-ordinators meeting

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Ethology

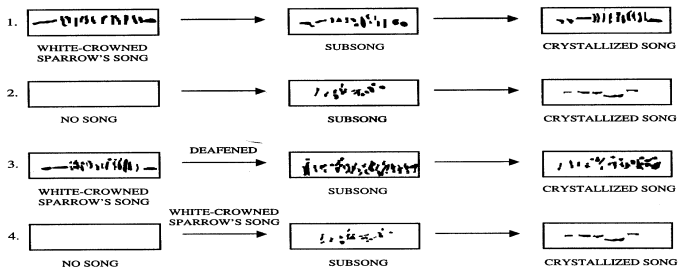
A 73. When a worker bee stings to defend itself, its sting often remains blocked in the enemy's flesh, which in turn causes bee's death. Assuming that defence is suicidal for a bee, how could you explain the persistence of such behaviour?

- A. honey bees are naturally aggressive.
- B. sometimes, the sting doesn't remain stuck in the opponent's flesh, and the bee can reuse it's weapon.
- C. due to altruism.
- D. because the bees which are more exposed to fighting enemies outside the hive are also the oldest ones and are thus near the end of their life expectancy.

A 74. Why are mammals often polygamous, whereas birds are frequently monogamous?

- A. females available for mating are more frequent in mammals.
- B. mammals, and not birds, display in leks.
- C. external fertilisation in birds requires the presence of the male to avoid new-laid eggs to be fertilised by competitors.
- D. breast-feeding by the females in mammals, but not in birds, makes males investment in brood care less necessary.

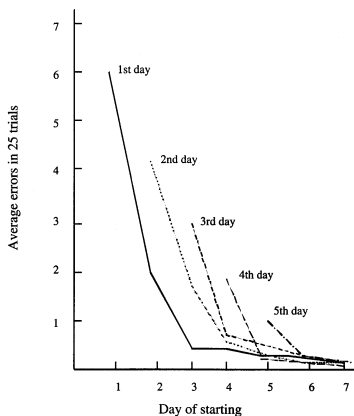
A 75. P. Marler has carried out many experiments to determine the role of the genes (inheritance) and the environment (learning) in song acquisition in males of the white-crowned sparrow *Zonotrychia leucophrys*. His results are shown in the following illustration:



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1. normal course of development : the bird hears its species' song while young (first 50 days), and initially produces a subsong, which crystallises into the final adult song characteristic of the species.
 2. the juvenile bird is isolated from the sound of all songs.
 3. the juvenile bird is allowed to hear normal songs during the first 50 days after birth, but is then deafened.
 4. the juvenile bird is isolated from the sound of all songs during the first 50 days. It then receive songs of its own species.
What can you conclude from these experiments?
- A. hearing the song of its own species is sufficient to develop a normal song.
- B. young adults must hear the song of an adult male and need to train themselves to reproduce it correctly.
- C. chicks must hear the song of an adult male and need to train themselves before developing a normal song ; learning is only possible if chicks hear the song during a critical period of 50 days following birth.
- D. singing does not require any learning and develops according to a maturation process.

A 76. As shown below, as soon as a domestic hen chick hatches it starts pecking at grains that look like food, and as it grows older its aim at food grain improves. Note that if a chick is prevented from pecking at food during its second day, it will still be better at pecking on its third than on its first day ; however, it will not be as accurate as it would have been if it had been allowed to practice. What are the necessary mechanisms for the development of an accurate pecking in chicks?



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- A. accurate pecking develops following maturation of the nervous system.
- B. accurate pecking develops by learning allowing the chicks to distinguish between alimentary items.
- C. both processes of maturation and learning are involved in accurate pecking.
- D. there is a critical period - ranging from day 1 to day 7 - during which the chicks learn how to peck food on the ground.

A 77. Passerine birds may produce different types of sounds and alarm calls. The songs of males birds differ between species. Basically, they have two main functions : defending the territory and attracting/stimulating females to mate. Alarm calls are emitted when birds spot a dangerous predator flying over. Alarm calls when a hawk flies over stimulate other nearby birds to take action to escape. Whereas the songs of male birds are different between species, alarm calls of several species sound similar i.e., they share certain common acoustic properties. How do you explain this cross-species similarity of alarm calls?

- A. there is a convergent evolution of alarm calls because their acoustic properties make the call difficult to locate.
- B. there is a convergent evolution of alarm calls because their acoustic properties allow the caller to locate precisely the predator flying over.
- C. there is a convergent evolution of alarm calls with simple acoustic properties, because simple alarm calls are easily and rapidly learned by young birds.
- D. predators escape when hearing long calls, because such calls are also emitted by their own predators.

A 78. DELETED

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Genetics - Evolution

A 79. In cats, black colour is caused by an X-linked allele; the other allele at this locus causes orange colour. The heterozygote is tortoise-shell. What kind of offspring would you expect from the cross of a black female and an orange male?

- A. tortoise-shell female; tortoise-shell male.
- B. black male; orange female.
- C. tortoise-shell female; orange male.
- D. tortoise-shell female; black male.

A 80. A man is brought to court in a paternity case. His blood type is B, Rh positive. The mother blood type is B, Rh negative. The child's blood type is A, Rh negative. What can be said about the man's chances of being the father?

- A. he is not the father.
- B. he might be the father.
- C. he is the father.
- D. he might not be the father.

A 81. The fact that all seven of the garden pea traits studied by Mendel obeyed the principle of independent assortment means that:

- A. the haploid number of garden peas is 7.
- B. the formation of gametes in plants is obtained by mitosis only.
- C. the seven pairs of alleles determining these traits behave as if they were located on different chromosomes.
- D. seven pairs of alleles determining these traits are located on the same pair of homologous chromosomes.

A 82. Given the parents AABBCc x AabbCc, with simple dominance and independent assortment for each of the three characters. What proportion of the progeny will be expected to phenotypically resemble the first parent?

- A. 1/4.
- B. 3/4.
- C. 1/8.
- D. 3/8.

A 83. Two true-breeding stocks of garden peas are crossed. One parent had red, axial flowers, and the other had white, terminal flowers. In F1 all individuals had red, axial flowers. If 1000 F2 offspring resulted from the

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cross and assuming independent assortment, how many of them would you expect to have red, terminal flowers?

- A. 190.
- B. 65.
- C. 250.
- D. 550.

A 84. Three babies were recently mixed up in a hospital. After consideration of the data below, which of the following represents the correct baby/parent series of combinations?

Couple	I	II	III
Blood groups	A and A	A and B	B and O
Baby	1	2	3
Blood groups	B	O	AB

- A. I-3, II-1, III-2.
- B. I-1, II-3, III-2.
- C. I-2, II-1, III-3.
- D. I-2, II-3, III-1.

A 85. There is good evidence for linkage when:

- A. two genes occur together in the same gamete.
- B. a given gene is associated with a specific phenotype.
- C. genes do not segregate during meiosis.
- D. a single gene influences two traits.

A 86. Genes A and B are linked 12 map units apart. A heterozygous individual, whose parents were Aabb and aaBB, would be expected to produce gametes in the following frequencies:

- | | | | | |
|----|---------|---------|---------|---------|
| A. | 44 % AB | 6 % Ab | 6 % aB | 44 % ab |
| B. | 6 % AB | 44 % Ab | 44 % aB | 6 % ab |
| C. | 12 % AB | 38 % Ab | 38 % aB | 12 % ab |
| D. | 6 % AB | 6 % Ab | 44 % aB | 44 % ab |

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A 87. The Darwinian fitness of an individual is measured by:

- A. the number of its offspring that survive to reproduce.
- B. the number of mates it attracts.
- C. its physical strength.
- D. how long it lives.

A 88. Among the various mice dihybrid crosses indicated below, which one will give the best chance to obtain in one litter a mouse with genotype AABb:

- A. AaBb x AaBb.
- B. AaBb x AABb.
- C. AABB x aaBb.
- D. AaBb x AaBB.

A 89. Two individuals are differing by one character. When crossed together all the offsprings belong to the parental phenotypes. Which of the following ratios between the two observed phenotypes seem in accordance with the hypothesis of a single gene difference (monogenic trait):

- A. 421/416.
- B. 862/281.
- C. 762/435.
- D. 1201/304.

A 90. Considering an animal strain, which is pure for a particular trait:

- A. crossing of individuals from such a strain will not allow further selection of variants for that trait.
- B. offspring from such crossing experiments will consist exclusively in homozygotes at any locus considered, including the locus responsible for the particular trait.
- C. crossing is rendered impossible because sterility invariably arises.
- D. crossing of individuals from such a strain is a way to obtain hybrid offspring for that trait.

A 91. Phenylketonuria (PKU) is a genetic disease caused by a recessive mutation. If both parents are heterozygous for the gene, what is the probability for a normal child to be heterozygous?

- A. 0.
- B. 1/2.
- C. 2/3.
- D. 3/4.

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A 92. How many different kinds of gametes can a trihybrid produce, considering that only independent assortment occurs during meiosis (no crossing over)?

- A. 4.
- B. 8.
- C. 2×23 .
- D. 6.

A 93. Suppose you are able to observe under the microscope the total number of meiosis occurring in one gonad of a given individual and to outnumber exactly the crossovers between two given loci for which that individual is dihybridic. If the frequency of these particular crossovers is 100% (that is to say that every meiosis exhibits one crossing over between the two loci you consider) you anticipate that the total percentage of recombinant gametes would be equal to:

- A. 100 %
- B. 50 %
- C. 25 %
- D. 12.5 %

A 94. The sequence of a variant of the human globin protein shows a difference at aminoacid number 40 and another difference at aminoacid number 60 as compared to the normal protein. The number of nucleotides between the two point mutations in the DNA of the corresponding gene is necessarily:

- A. a multiple of 3.
- B. a multiple of 20.
- C. at least 60.
- D. at least 57.

A 95. A tomato plant that is heterozygous for a gene that makes stems purple or green and also for a gene that makes foliage hairy or hairless is test crossed to a green hairless plant and the 500 progeny are outnumbered as follows: 42 purple, hairy; 202 purple, hairless; 209 green, hairy; 47 green, hairless. The distance (in cM or m.u.: map units) between these genes is:

- A. 17.8 cM.
- B. 35.6 cM.
- C. 8.9 cM.
- D. 89 cM.

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A 96. DELETED

A 97. Which of the following statement is in agreement with the Hardy-Weinberg law:

- A. in a climax ecosystem, energy flow is constant.
- B. in a panmictic population, the allele frequencies remain constant from one generation to another.
- C. individuals are taller under high latitudes.
- D. in a population, the mutation frequency compensates the selection pressure.

A 98. As we go from ferns through gymnosperms to angiosperms, the following evolutionary trend can be observed:

- A. an increasing dominance of the sporophyte and a reduction of the gametophytic generation.
- B. an increasing dominance of the gametophyte developing vessels and sieve tube elements with companion cells in angiosperms.
- C. an increasing dominance of the sporophyte developing tracheids and sieve cells with albuminous cells in angiosperms.
- D. an increasing dominance of the sporophyte while the gametophyte remains unaltered.

A 99. During Paleozoic era, tree forms are especially dominant during:

- A. Silurian.
- B. Devonian.
- C. Carboniferous.
- D. Permian.

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Ecology

A 100. In a big lake under temperate climate, the temperature drop in winter provokes:

- A. a mixing of the mineral nutrient.
- B. the migration of phytoplankton.
- C. a thermal stratification.
- D. a strong mortality of fishes.

A 101. DELETED

A 102. Soil and cave animals share some common features: which of the following is not correct?

- A. a reduction of pigmentation.
- B. a reduction of visual performances.
- C. a reduction of all sensory organs.
- D. an adaptation to constant abiotic conditions.

A 103. Which ecological unit incorporates abiotic factors?

- A. community.
- B. ecosystem.
- C. population.
- D. species.

A 104. While local conditions such as heavy rainfall or the removal of plants limits the amount of nitrogen, phosphorus, or calcium available to a particular ecosystem, the amount of carbon available to the system is seldom a problem. The reason therefore is:

- A. that organisms do not need very much carbon.
- B. that plants can make their own carbon using water and sunlight.
- C. that many nutrients come from the soil, carbon comes from the air.
- D. that plants are better at absorbing carbon from the soil.

A 105. DELETED

A 106. DELETED

A 107. DELETED

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A 108. DELETED

A 109.

1. all autotrophic organisms are also phototrophic.
2. of the total light energy reaching the atmosphere, only about 1 % is utilised in photosynthesis.
3. light intensity and quality changes vertically through a forest canopy.
4. light intensity and quality changes vertically through a water column.

Which of the above combination of sentences is correct?

- A. 1,3,4.
- B. 2,3,4.
- C. 3,4.
- D. 1,2,3,4.

A 110. Which of the following factors tends to be the most important factor controlling primary productivity in the oceans?

- A. solar radiation.
- B. temperature.
- C. dissolved oxygen.
- D. nutrients.

A 111. A uniform pattern of dispersion is likely to be found in which type of habitats and under what condition?

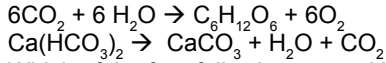
- A. homogeneous distribution of essential resources, high population density.
- B. heterogeneous distribution of essential resources, high population density.
- C. homogeneous distribution of essential resources, low population density.
- D. heterogeneous distribution of essential resources, low population density.

A 112. The cultural eutrophication of lakes often reduces the oxygen content to a risky level. The main reason for this excessive oxygen reduction is:

- A. the oxygen consumption of plants.
- B. the oxygen consumption of fishes.
- C. the oxygen consumption of decomposers.
- D. the oxidation of nitrates and phosphates.

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A 113. “ Corals” are marine cnidarians. Those building coral reefs live in shallow and translucent water. They contain Zooxanthellae symbiotic algae in their endoderm. The following chemical reactions may help you:



Which of the four following propositions isn't correct?

- A. reef corals get exogenous food by several different ways (cnidoblasts, contact digestion, angling with mucous filaments).
- B. reef corals “help” their symbiotic algae by giving them amino acids and glucose and receive from them glycerol and growth vitamins.
- C. reef corals of the euphotic zone have lost cnidoblasts and do not need any longer because their zooxanthellae cover all their needs.
- D. the carbon dioxide used for precipitating CaCO_3 results from zooxanthellae.

Biosystematics

A 114. Which of the following metazoan groups is characterised by a bilateral symmetry?

- A. hydrozoa.
- B. porifera.
- C. cephalochordata.
- D. echinodermata.

A 115. DELETED

A 116. Indicate which of the following cavities has a coelomic origin:

- A. pulmonary cavity.
- B. bladder cavity.
- C. peritoneal cavity.
- D. uterine cavity.

A 117.

- I. Odonata - Hymenoptera.
- II. Coleoptera - Orthoptera.
- III. Orthoptera - Homoptera.
- IV. Hemiptera - Coleoptera.
- V. Lepidoptera - Mecoptera.

In which of the above insect orders do the anterior (front) and posterior (rear) pairs of wing have different structures and are mouthparts of the chewing type?

- A. only II.
- B. I and II.
- C. only III.
- D. IV and V.

A 118. Of the following statements, mark the one, that is a characteristic feature of reptiles:

- A. dry skin with epidermal derivatives and cutaneous respiration.
- B. respiration only with lungs and stable body temperature.
- C. development includes laying of eggs and a caterpillar stage.
- D. a respiratory system which includes trachea and lungs with a faveolus.

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A 119. Mark the incorrect statement about sponges:

- A. their skeletons consist of calcium, silicon dioxide or spongin needles.
- B. they gain food by phagocytosis.
- C. all known sponges live in seas or oceans.
- D. sponges can host many symbiotic species.

A 120. To which family does a plant with the following characteristics belong: 5 basely connate sepals, 5 free petals, many stamens, and a superior gynoeceium consisting of 5 fused carpels?

- A. Solanaceae.
- B. Rosaceae.
- C. Cactaceae.
- D. Ranunculaceae.

A 121. DELETED



Ssst...Concentration during the theoretical test