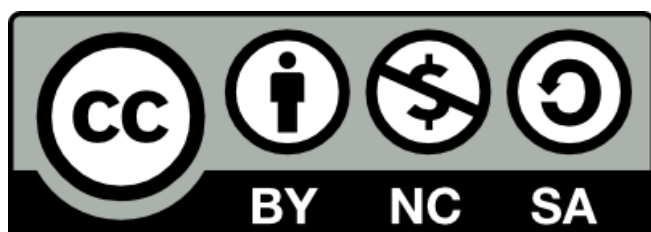




All IBO examination questions are published under the following Creative Commons license:



CC BY-NC-SA (Attribution-NonCommercial-ShareAlike) -
<https://creativecommons.org/licenses/by-nc-sa/4.0/>

The exam papers can be used freely for educational purposes as long as IBO is credited and new creations are licensed under identical terms. No commercial use is allowed.

17th INTERNATIONAL BIOLOGY OLYMPIAD
JULY 9-16, 2006
Río Cuarto – República Argentina



THEORETICAL TEST

PART A

Student code:	
---------------	--

GENERAL INSTRUCTIONS

- Please check that you have the appropriate examination papers and answer sheet, as well as a calculator and a black pencil.
- Use the answer sheet provided to record your answers.
- Remember to write down your personal code number on top of the answer sheet.
- All the questions are multiple choice and there is **ONLY ONE** correct answer.
- You must mark your answers in the answer sheet by filling in the corresponding box.
- Use the pencil provided to complete the answer sheet.
- You have 2 hrs 30 min (150 minutes) to answer the questions.
- The maximum score is approximately 82 points (1 point each question).

**PLEASE, REMEMBER: THE ACADEMIC COMMITTEE WILL CONTROL ONLY THE
ANSWER SHEET!**

GOOD LUCK IBO COMPETITORS!

17^o INTERNATIONAL BIOLOGY OLYMPIAD
THEORETICAL TEST
PART A

CELULAR BIOLOGY

1- Which of the following structures and processes can exist in both prokaryotic and eukaryotic cells?

- I. Nuclear envelope.
- II. Ribosomes.
- III. Introns.
- IV. ATP synthesis.
- V. Cell membrane.
- VI. DNA polymerase.
- VII. Cytoskeletal elements.
- VIII. rRNA 18S.

- A) I, II, III and VIII.
- B) II, IV, VI and VIII.
- C) I, III, V and VII.
- D) II, IV, V and VI.
- E) II, III, VI and VIII.

2- What structure in the bacterial cell has the most enzymatic activity?

- A) Cell membrane.
- B) Cell wall.
- C) Mesosome.
- D) Capsule.
- E) Flagellum.

3- Which of the following functions are carried out in the rough endoplasmic reticulum?

- I. Addition of carbohydrates to protein.
- II. Synthesis of lysosomal protein.
- III. Addition of carbohydrates to lipids.
- IV. Synthesis of membrane proteins.
- V. Formation of glycolipids.

3 Answers

- A) I, II and V.
- B) II, III and IV.
- C) II, IV and V.
- D) I, II and IV.
- E) III, IV and

4- Which of the following fibers bind to the cytoplasmic site of cell-matrix adherens junctions (focal adhesion)?

- A) Tubulin protein fibers.
- B) Collagen fibers.
- C) Actin protein fibers.
- D) Elastic fibers.
- E) Reticular fibers.

5- Nuclear pores permit the passage of:

- A) nucleotides inward and glucose outward.
- B) RNA inward and chromosome outward.

- C) proteins inward and RNA outward.
- D) potassium ions inward and protein outward.
- E) nucleotides inward and RNA outward.

6- Which is the function of the nucleolus?

- A) Import of cytoplasmic proteins.
- B) Regulation of nuclear pores.
- C) Site of ribosome assembly.
- D) Storage of inactive DNA.
- E) Synthesis of nuclear protein.

7- The activity of lysosomes is regulated by:

- A) cytoplasmic ions.
- B) lysosomal pH.
- C) temperature.
- D) calcium.
- E) nuclear DNA.

8- In which of the following processes the membrane integral proteins are **NOT** involved?

- A) Glucose carrier.
- B) Sodium ion channel.
- C) Surface receptor.

D) Urea carrier.

E) Sodium-potassium pump.

9- How do polypeptides find their way from the site of synthesis on the cytoplasmic ribosome to the place of their destination in the peroxisome?

A) By specific amino-terminal targeting signals.

B) By specific transport along the cytoskeleton.

C) By specific carboxy-terminal targeting signals.

D) By specific vesicular transport.

10- What is embedded in the thylakoid membrane of the chloroplast and protruding as knobs from the outer surface?

A) Enzymes that fix carbon dioxide.

B) Molecules of chlorophyll a and chlorophyll b.

C) P₇₀₀ or P₆₈₀ molecules.

D) Proton channels that synthesize ATP.

E) Water splitting complex.

11- Where are most proteins of respiratory chain in that carry out the oxidative metabolism in the mitochondrial structure located?

A) Dissolved within the fluid of the matrix.

- B) In the cytoplasm on the outer surface of the mitochondria.
- C) In the space between the two membranes.
- D) On the surface and embedded within the outer membrane.
- E) **On the surface and embedded within the inner membrane.**

12- Two sister chromatids fail to separate because microtubules became improperly attached to the kinetochores. What is the most likely result?

- A) Both chromatids will remain at the equator of the spindle.
- B) The mitosis process will stop immediately.
- C) One daughter cell will lose all its chromosomes.
- D) One daughter cell will lose one chromosome.

13- Which of the following lipids contain glycerol in their structure?

- A) Sphingolipids, Triacylglycerides, Cholesterol
- B) Phosphatidylcholine, Wax, β -Carotene
- C) Triacylglycerides, Phosphatidylcholine, Phosphatidylethanolamine
- D) Cholesterol, Phosphatidylcholine, Phosphatidylethanolamine
- E) Carotenoides, Sphingolipids, Phosphatidylcholine.

14- Which of the following reactions are likely to occur in the cytoplasm of an eukariotic cell?

- I. Krebs cycle.
- II. Oxidative catabolism of fatty acids

- III. Glycolysis
- IV. Lactic fermentation
- V. Etanol fermentation
- VI. Glyoxylate cycle

Answers

- A) I, IV, and VI.
- B) III, IV and V.
- C) II, I and III.
- D) II, IV and V.
- E) IV, V and I.

15- Which of the following statements corresponds to apoptosis (Programmed Cellular Death)?

- I. Enzymes known as caspases are involved
- II. Cellular swelling and plasmatic membrane lysis are observed.
- III. The nucleus degrades randomly into fragments.

IV. The product of the tumor-suppressing gene (p53 protein) activates in response to DNA damage.

V. It is a process that involves loss of energy.

Answers

A) I, IV and V.

B) II, III and IV.

C) I, II and V.

D) II, IV and V.

E) I, III and V.

16- Which of the following enzymes **DOES NOT** correspond to the Krebs cycle?

A) Isocitrate dehydrogenase

B) Succinate dehydrogenase

C) Citrate sintetase

D) Pyruvate carboilase

E) α -cetoglutarate deshidrogenase

PLANT ANATOMY AND PHYSIOLOGY

17- Which are the key terms to explain water transport in the xylem?

A) Root hairs, cations concentration, transpiration.

- B) Transpiration, tension, guttation.
- D) Tension, cavitation, guttation.
- E) Transpiration, cuticle, water potential.

18- Which of the following statements about the stomatal opening is true?

- A) The concentration of abscisic acid in the guard cells increases.
- B) Higher K^+ concentrations give guard cells a negative water potential.
- C) The Level of carbon dioxide in the spaces inside the leaf increases.
- D) Lower K^+ concentrations give guard cells a negative water potential.
- E) Potassium ions diffuse passively out of the guard cells.

19- An active sieve tube member is characterized by having:

- A) secondary wall, nuclear desintegration, sieve plates.
- B) primary wall, central vacuole, a nucleus.
- C) secondary wall, large amounts of callosa, sieve plates.
- D) primary wall, bordered pits, a nucleus.
- E) primary wall, sieve plates, desintegrated nucleous and tonoplast.

20- Which of the following statements is not related to plants pollinated by wind (anemophily)?

- A) They have large, divided or plumose stygma.
- B) They produce a large quantity of pollen.
- C) They have not showy flowers.

- D) They have smooth and dry pollen.
- E) They present flowers of diverse colors and agglutinated pollen.

21- The function of the aleurone layer in the caryopsis is:

- A) to protect the embryo.
- B) to produce and release enzymes that degrade the starch and proteins of the endosperm.
- C) to produce gibberellins.
- D) to synthesize carbohydrate.
- E) to accumulate water.

22- The potato (*Solanum tuberosum*) tuber is characterized by:

- A) being a modified underground stem.
- B) accumulating large quantity of starch.
- C) being a kind of asexual reproduction.
- D) containing several buds.
- E) all of them are true.

23- An aggregate fruit is originated from:

- A) a set of flowers clustered in a receptacle.
- B) a flower with several carpels and a syncarpous gynoecium.
- C) a flower with syncarpous gynoecium and axile placentation.
- D) a flower with several separated carpels.

E) several flowers around an axis.

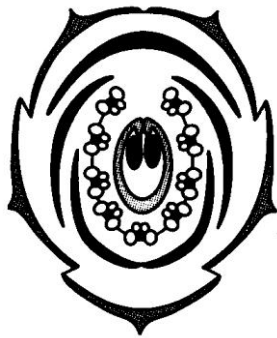
24- In a laboratory, stems and roots of different plants were cut. When putting them into a box the slides mixed. Which of the following cross sections corresponds to a primary root of Magnoliopsida?

A)	Epidermis	Cortex	Bicollateral bundles	Pith
B)	Epidermis	Cortex	Pericycle	4 xylem strands alternate with 4 phloem strands
C)	Periderm	Secondary Phloem	Cambium	Secondary Xylem
D)	Epidermis	Cortex	Pericycle	20 xylem strands alternate with phloem
E)	Epidermis	Sclerenchyma	Scattered vascular bundles	Hollow pith

25- Which of the following combinations present primary walls in an adult plant?

A)	Vessels members	Meristematic cells	Parenchyma cells
B)	Colenchyma cells	Fibres	Sieve tube member
C)	Sclereids	Colenchyma cells	Sieve cells
D)	Meristematic cells	Tracheary elements	Colenchyima cells
E)	Sieve elements	Meristematic cells	Colenchyma cells

26- Identify the following characteristics in the floral diagrams below: Calix and corolla with the same number of parts in each whorl, the number of stamens are twice the number of sepals and petals, gynoecium with 5 carpels.



I



II



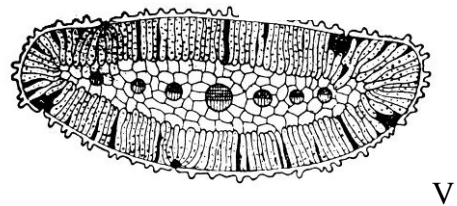
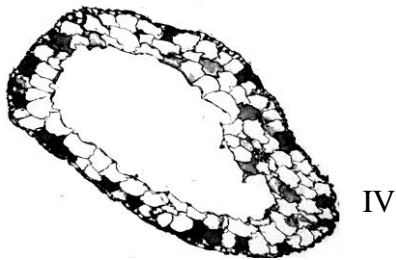
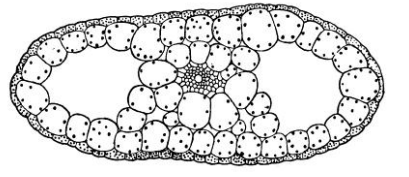
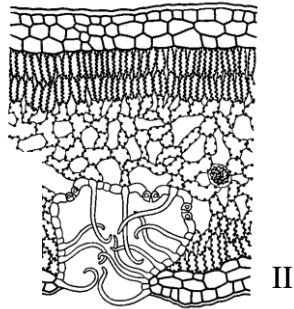
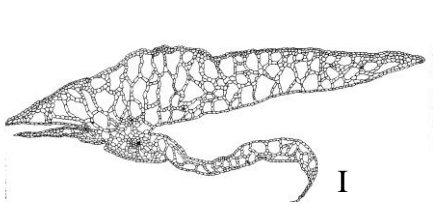
III



IV

- A) I, II and IV.
- B) II and III.
- C) III and IV.
- D) I, II and III.
- E) I and IV.

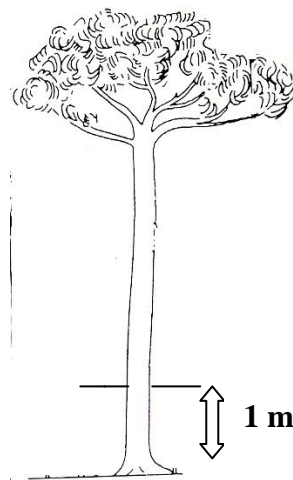
27- The following figures correspond to cross sections of leaves. Which one/s correspond/s to a hydrophytic habitat?



- A) I, II and III.
- B) II.
- C) I, III, IV and V.
- D) I, II and V.
- E) I, III and IV.

28- In a 5-m-tall young Eucalyptus, a person stuck 2 long nails horizontally and opposite to each other in its trunk, at a height of 1.0 m. Today the tree is 10 m tall. Are there changes in the height above the ground and the distance between the two nails?

- A) The height of the two nails above the ground increases due to the activity of vascular cambium.
- B) The height of the two nails above the ground remains unchanged because primary growth occurs in the stem tip.
- C) The distance between the two nails will increase due to activity of vascular cambium.
- D) The height and distance between the two nails increase due to activity of the intercalary meristem.
- E) Both B and C are true.



ANIMAL ANATOMY AND PHYSIOLOGY

**** Regulation of body temperature is fundamental in the organisms. The balance between production and loss of heat determines the body temperature. In vertebrates like reptiles, amphibians and fish the body temperature fluctuates within a considerable range. In birds and mammals there exists a group of reflex responses that integrate to keep/maintain the body temperature within a narrow range in spite of the fluctuations of the atmosphere.**

The following 4 questions are related to this introduction.

29- Body temperature in mammals is regulated by:

- A) spinal cord.
- B) medulla oblongata.
- C) hypothalamus.
- D) cerebellum.

30- A naked person inside a room at 21° C of temperature and 80% humidity will lose heat mainly because of:

- A) an increment of the metabolism.
- B) miction.
- C) breathing.
- D) radiation and conduction.
- E) sweat evaporation.

31- In a dehydrated person, corporal water must be replaced by means of intravenous infusion of:

- A) distilled water.
- B) a 2 % sodium chloride solution.
- C) a 5% glucose solution.
- D) a mixture of 1% glucose and sodium chloride solutions.

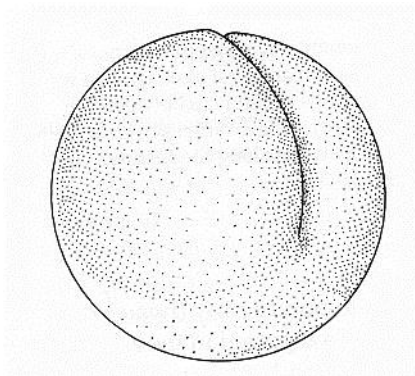
32- Select the correct combination of the temperature regulating mechanisms activated by cold:

- A) perspiration - cutaneous vessel constriction - increased breathing.
- B) cutaneous vessel constriction - piloerection - increased adrenalin secretion.
- C) cutaneous vessel expansion - increased breathing – shivering.
- D) increased adrenalin secretion – perspiration - piloerection.

In the 18th century the Italian clergyman Lazaro Spallanzani (1729-1799), developed a very ingenious experience with the frogs in his swimming pool. He dressed some males with **tight** trousers to prevent the spreading of the semen into the water. That summer, Spallanzani did not have any tadpoles in his swimming pool. He collected the semen drops from the shorts and noticed that when he added them to the ova deposited by the females during amplexus, the ova developed into tadpoles.



Spallanzani's frogs



The clergyman concluded that the ovum requires contact with semen to be fertilized. Without knowing, he was the precursor of artificial fertilization. Spallanzani also observed that in the fertilized eggs there appeared a furrow that had also been observed by other researchers before. That furrow is the beginning of the frog developmental stages.

Eggs observed by Lázaro Spallanzani

Since then, developmental Biology has acquired significant advances, and at present the embryonic development of the amphibia is well known.

33- Which of the following statements about amphibia development are correct?

I. Amphibia have mesolecithal eggs.

II. The blastomeres in the animal pole are smaller than in the vegetative / vegetal pole.

III. Yolk is concentrated in the vegetative / vegetal pole.

IV. Amphibians display holoblastic cleavage.

Answers

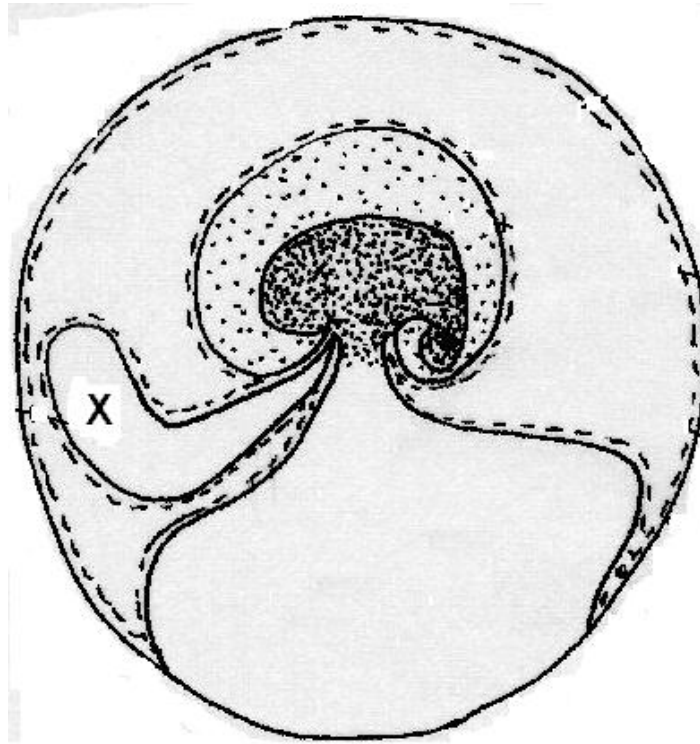
A) I, II, and IV.

B) I and III.

C) II and IV

D) I, II, III and IV.

The amniotic egg is one of the major adaptations in the evolution of the vertebrates. The following scheme corresponds to an amniotic egg.



34 - The embryonic membrane marked with an X corresponds to:

- A) chorion.
- B) allantoids.
- C) amnion.
- D) yolk sac.

35- One of the extra embryonic membranes produces proteins and lymphocytes which suppress the immune response the mother's body would present against the fetus. This membrane is:

- A) the allantois.
- B) the chorion.
- C) the yolk sac.
- D) the amnion.

36- If the corpus luteum of a pregnant woman is removed before the eleventh week of pregnancy:

- A) the pregnancy proceeds because there is no connection between the corpus luteum and pregnancy during this period of gestation.
- B) the placenta has already secreted enough progesterone and estrogen to sustain the pregnancy.
- C) the embryo is spontaneously aborted.
- D) none of the given answers is correct.

37- The three embryonic layers established during gastrulation in mammals subsequently differentiate into specific tissues and organs.

Select the correct pair:

- A) Mesoderm – liver.
- B) Endoderm - dental enamel.
- C) Ectoderm – crystalline lens.
- D) Mesoderm - thyroid.

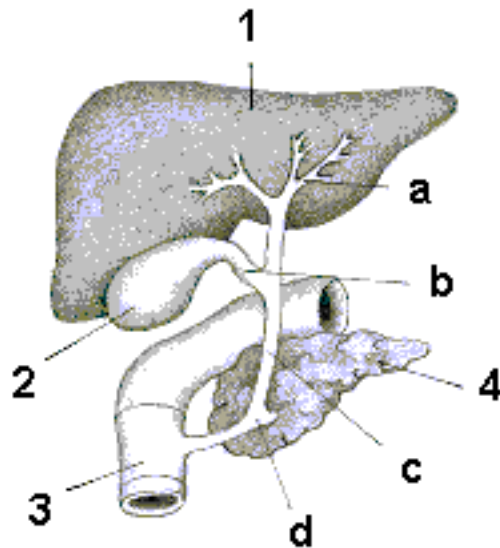
38- From which part of the paraxial mesoderm do the vertebrae develop?

- A) Sclerotome.
- B) Dermatome.
- C) Myotome
- D) Hypomere.

39- Select the correct sequence with relation to the embryonic origin of the nervous system.

- A) Neural tube – neural plate - neural fold - neural crest.
- B) Neural plate - neural crest - neural tube - neural fold.
- C) Neural crest - neural plate - neural fold – neural tube.
- D) Neural plate – neural fold - neural crest - neural tube.

The following 5 questions are related to the scheme:



40- Upon which organs in the diagram the cholecystikinin (CCK) acts?

- A) 1; 2; 3 and 4.
- B) 2 and 3.
- C) 2 and 4.
- D) 3 and 4.
- E) 1; 3 and 4.

41- Which of following proteins are synthesized by the **organ marked with 1** in the scheme?

- I. Albumin.
- II. Fibrinogenous.
- III. Transferrin.
- IV. Angiotensyn.

Answers

- A) I, II and IV.
- B) II, III and IV.
- C) I and III.
- D) II and IV.
- E) All of them are correct.

42- The structure marked with **letter c** corresponds to the:

- A) Cystic duct.
- B) Common hepatic duct.
- C) Pancreatic duct.
- D) Choledoco.

43- Which of following enzymes are secreted by **organ 4** in the scheme?

- I. Nucleases.
- II. Lypase.
- III. Pepsin.
- IV. Trypsin.
- V. Lactase.
- VI. Chymotrypsin.

Answers

- A) I, III and VI.
- B) I, II, IV and VI.
- C) II, IV and VI.
- D) I, III, IV and VI.

44- **Organ 4** of the scheme also has an endocrinous function. One of the main hormones it releases is insulin. Which one of the following triplets is true regarding the effects of Insulin on fat tissue (adipose tissue), muscle and liver?

	Fat tissue	Muscle	Liver
A)	Increase in glucose entry.	Decrease in glucose entry	Decrease in lipid synthesis
B)	Increase in glucose entry	Increase in glycogen synthesis	Decrease in ketogenesis
C)	Increase in fat acids synthesis	Decrease in glycogen synthesis	Increase in ketogenesis
D)	Decrease in fat acids synthesis	Decrease in aminoacid acquisition	Decrease in protein synthesis

GENETICS

**** The armadillo is a placental mammal of the order Xenarthra, family Dasypodidae, mostly known for having a bony armour shell made up of small, overlapping scales. All species are native to the American continent, where they inhabit a variety of environments.**

45- This remarkable animal is the only known species that always produces monozygotic multiple offspring. After 140 days of gestation a female “armadillo” gives birth to 4 naked babies with soft armour. We expect that:

- A) the genotype of the four babies is the same as their mother's.
- B) all of these “armadillo” babies have the same genotype.
- C) the babies are of different sexes.
- D) the four babies are haploid.
- E) the four babies have different phenotypes.

46- In an electrophoretic study of enzyme variation in one species of *Dasypus* you find 31 individuals A_1A_1 , 24 A_1A_2 and 5 A_2A_2 , in a sample of 60. Which are the frequencies of alleles A_1 and A_2 ?

- A) $p(A_1) = 0.72$; $q(A_2) = 0.28$.
- B) $p(A_1) = 0.52$; $q(A_2) = 0.48$.
- C) $p(A_1) = 0.92$; $q(A_2) = 0.028$.
- D) $p(A_1) = 0.28$; $q(A_2) = 0.72$.
- E) $p(A_1) = 0.48$; $q(A_2) = 0.52$.

47- Is the above population in Hardy-Weinberg equilibrium?

Table: χ^2 -Distribution

df	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	---	---	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.91	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.15	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278

A) Yes.

B) No.

C) It is not possible to determine.

48- If in another population the frequency of the A_1A_1 genotype is 0.25 and the frequency of the A_1A_2 genotype is 0.45, in Hardy-Weinberg equilibrium, the frequency of matings between the A_2A_2 and A_2A_2 genotypes would be:

A) 0.063.

B) 0.300.

C) 0.090.

D) 0.112.

E) 0.075.

49- Among the offspring of a given mating of “armadillos”, a phenotypic ratio of 9:3:3:1 is discovered. This is a result of:

- A) epistasis.
- B) linkage.
- C) independent assortment.
- D) pleiotropy.
- E) polyploidy.

50- Two male specimens of the rodent *Akodon molinae* belonging to the same population were analyzed cytogenetically: One of them had 43 and the other 42 chromosomes. The Fundamental Number (number of chromosome arms in a somatic cell) was 44 in both of them. This may be due to:

- A) chromosome loss.
- B) an inversion.
- C) Robertsonian translocation.
- D) presence of B chromosomes.
- E) polyploidy.

51- Which of the following statements is **NOT** true with respect to an X-linked recessive inheritance?

- A) It affects mainly males.
- B) There is no male-to-male transmission in the pedigree.
- C) Females may be affected if the father is affected and the mother is a carrier.
- D) It affects either sex, but females are more affected than males.
- E) Affected males are usually born to unaffected parents.

52- In chickens there exists a genetic condition called “creeper” (very short crooked legs). A cross of affected chickens, produced a progeny of 775 creepers and 388 normal chicks. The closest phenotypic ratio is:

- A) 3 : 1.
- B) 2 : 1.
- C) 1 : 1.
- D) 3 : 2.
- E) 4 : 1.

53- What is the mode of inheritance of the creeper trait in the above question?

- A) Sex-limited.
- B) Autosomal recessive-lethal.
- C) Epistatic to the normal allele.
- D) Both a and b.
- E) X-linked recessive.

54- You carry out a cross between homozygous purple-eyed flies with vestigial wings, and wild-type flies. The resulting F_1 flies are all phenotypically wild-type. In the progeny of the testcross of F_1 females you observe the following phenotypes:

Phenotype	Progeny
Purple-eyed, vestigial wings	1193
Purple-eyed, normal wings	159
Red-eyed, vestigial wings	161
Red-eyed, normal wings	1129

What is the map distance between these two loci?

- A) 12.2 map units.
- B) 48.2 map units.
- C) 6.2 map units.
- D) 24.4 map units.
- E) none of the above.

55- In order to study a viral polymerase, a scientist decided to express the encoding gene in *Escherichia coli* using the recombinant DNA technology. Choose the correct option about steps mentioned below, in the right order.

- a. cloning into an expression vector.
- b. disruption of cells and isolation of cytoplasmic fraction.
- c. induction of protein expression.
- d. isolation of viral genomic RNA from purified virions.

- e. PCR (polymerase chain reaction).
- f. reverse transcription.
- g. selection of the desired clone.
- h. transformation into *Escherichia coli* cells.

Answer

- A) d, f, e, a, h, g, c, b.
- B) d, b, c, a, h, e, f, g.
- C) h, g, a, b, d, f, c, e.
- D) d, f, e, h, g, b, c, a.

56- Which of the three options (A, B, C or D) shows the characteristics of the DNA molecule under physiological conditions?

	Base pairs (bp) per turn	Diameter	Distance between two successive base pairs	Form
A)	12 bp	2 nm	34 nm	A
B)	10 bp	1 nm	3.4 nm	B
C)	10 bp	2 nm	3.4 nm	B
D)	11 bp	1 nm	3.4 nm	A

57- A DNA molecule has 160 base pairs and 20 percent of adenine nucleotides. How many cytosine nucleotides are present in this molecule?

- A) 96 cytosine nucleotides.
- B) 60 cytosine nucleotides.
- C) 160 cytosine nucleotides.
- D) 40 cytosine nucleotides.
- E) 48 cytosine nucleotides.

58- *In vivo* cloning of genomic DNA requires some of the following:

- I. DNA polymerase.
- II. restriction endonucleases.
- III. a probe.
- IV. DNA ligase.
- V. a host.
- VI. donor DNA.
- VII. methylases.
- VIII. proteases.
- IX. a vector.
- X. Taq DNA polymerase.

Answer

- A) I, III, IV, V and VI.
- B) II, IV, V, VI and IX.
- C) II, V, VI, VII and IX.
- D) IV, V, VI, IX and X.

ECOLOGY

59- The following graph represents the hypothetical results of an experiment designed to recognize which nutrients can act as limitants of productivity in a salinized water lake. According to the areas of limitation, determine the lines in the graphic which correspond to each of these nutrients: phosphorus, nitrogen, iron and copper.

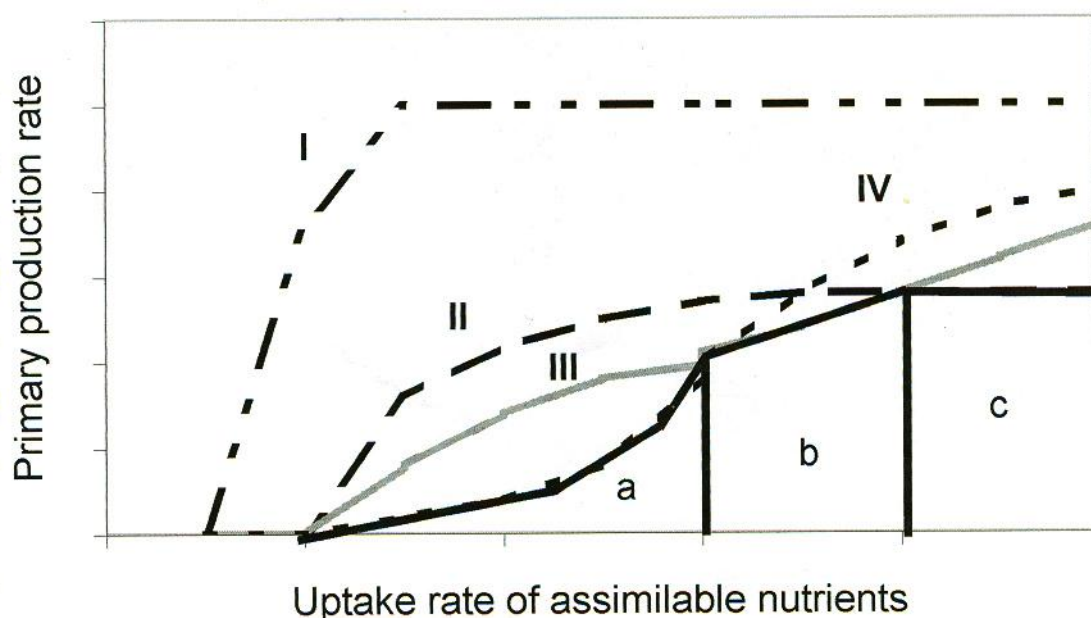
References

Solid black line: primary production.

a) Iron limitation area.

b) Nitrogen limitation area.

c) Phosphorus limitation area.



A) I = iron, II = nitrogen, III = phosphorus, and IV = copper.

B) I = copper, II = phosphorus, III = nitrogen, and IV = iron.

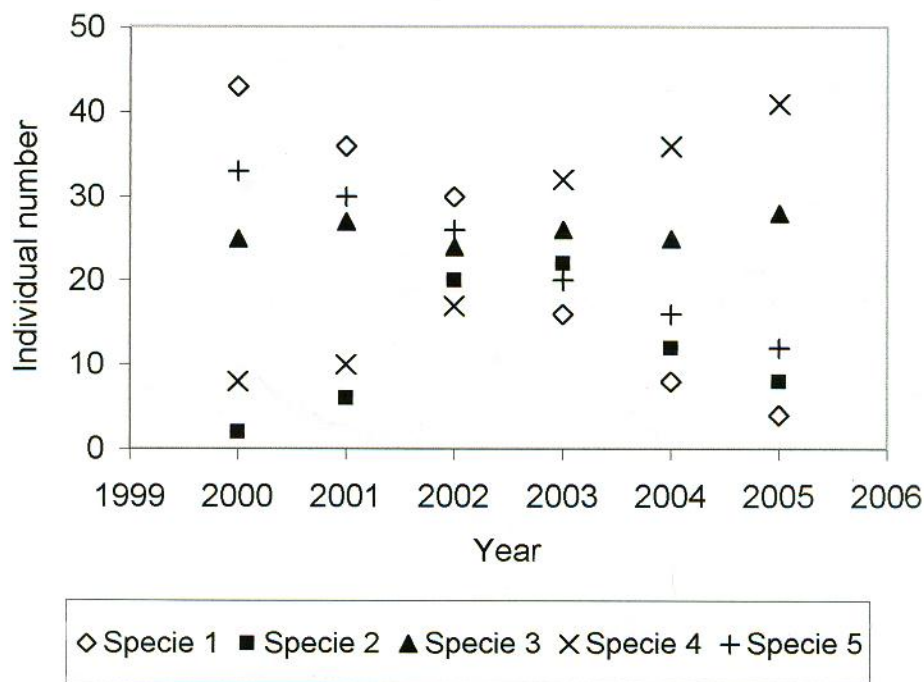
C) I = nitrogen, II = phosphorus, III = iron, and IV = copper.

D) I = copper, II = nitrogen, III = iron, and IV = phosphorus.

E) I = iron, II = copper, III = phosphorus, and IV = nitrogen.

**** During a period of six years, the variation in abundance for five animal species was registered in the month of October in order to verify the recovery of the fauna of a contaminated lake after a decontamination process initiated in 1999. The abundance values are shown in the following figure.**

The following 4 questions are related to the figure.



60- Abundance of species 3 tends to:

- A) diminish with time.
- B) rise with time.
- C) remain constant with time.
- D) fluctuate at random with time.
- E) fluctuate systematically.

61- The highest density of species 2 was registered in the years:

- A) 2000 and 2001.
- B) 2002 and 2003.
- C) 2003 and 2004.
- D) 2004 and 2005.
- E) None of the above answers is correct because there is not complete information.

62- The species that allowed evaluating the reduction of contamination were:

- A) 1; 2; and 3.
- B) 2; 3; and 5.
- C) 3; 4; and 5.
- D) 1; 4; and 5.
- E) 2; 4; and 5.

63- The reduction of contamination allowed the species richness:

- A) to rise with time.
- B) to diminish with time.
- C) not to change with time.
- D) to fluctuate at random with time.
- E) to fluctuate systematically with time.

64- In the same way as a population, a community shows several properties. Which of the following characteristics correspond to the community level?

- A) Species diversity, stratification, relative abundance of females, and trophic webs.
- B) Species diversity, age distribution, deaths of individuals, and trophic webs.
- C) Cohorts diversity, dominance, age distribution, and trophic webs.
- D) Species diversity, dominance, relative abundance, and trophic webs.
- E) Species diversity, density, deaths of individuals, and age structure.

**** In the following figure five examples of interactions are shown.**

References

R: limiting resources.

C: consumers.

E: natural enemies.



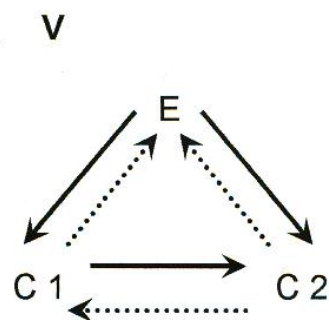
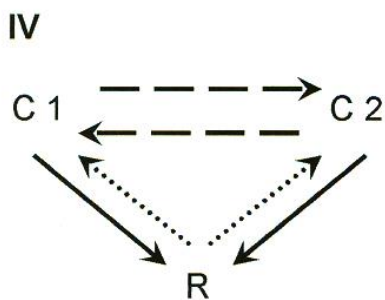
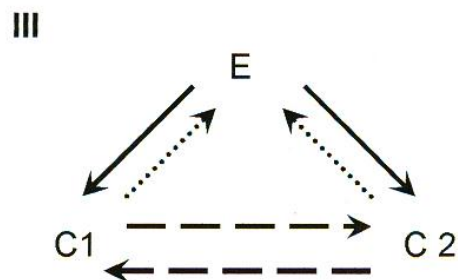
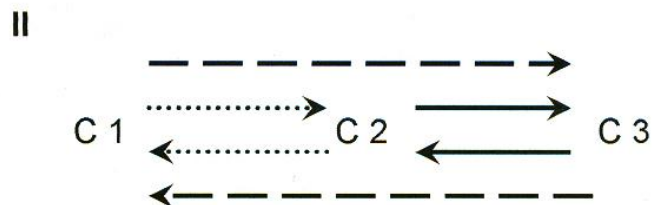
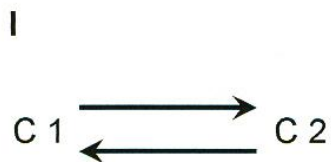
: direct interaction and negative influence.



: indirect interaction and negative influence.



: direct interaction and positive influence.



The following two questions are related to the above figure.

65- Identify two situations of competition, and two of apparent competition:

A) I and II; III; and IV.

B) I and V; II; and IV.

C) III and II; IV; and I.

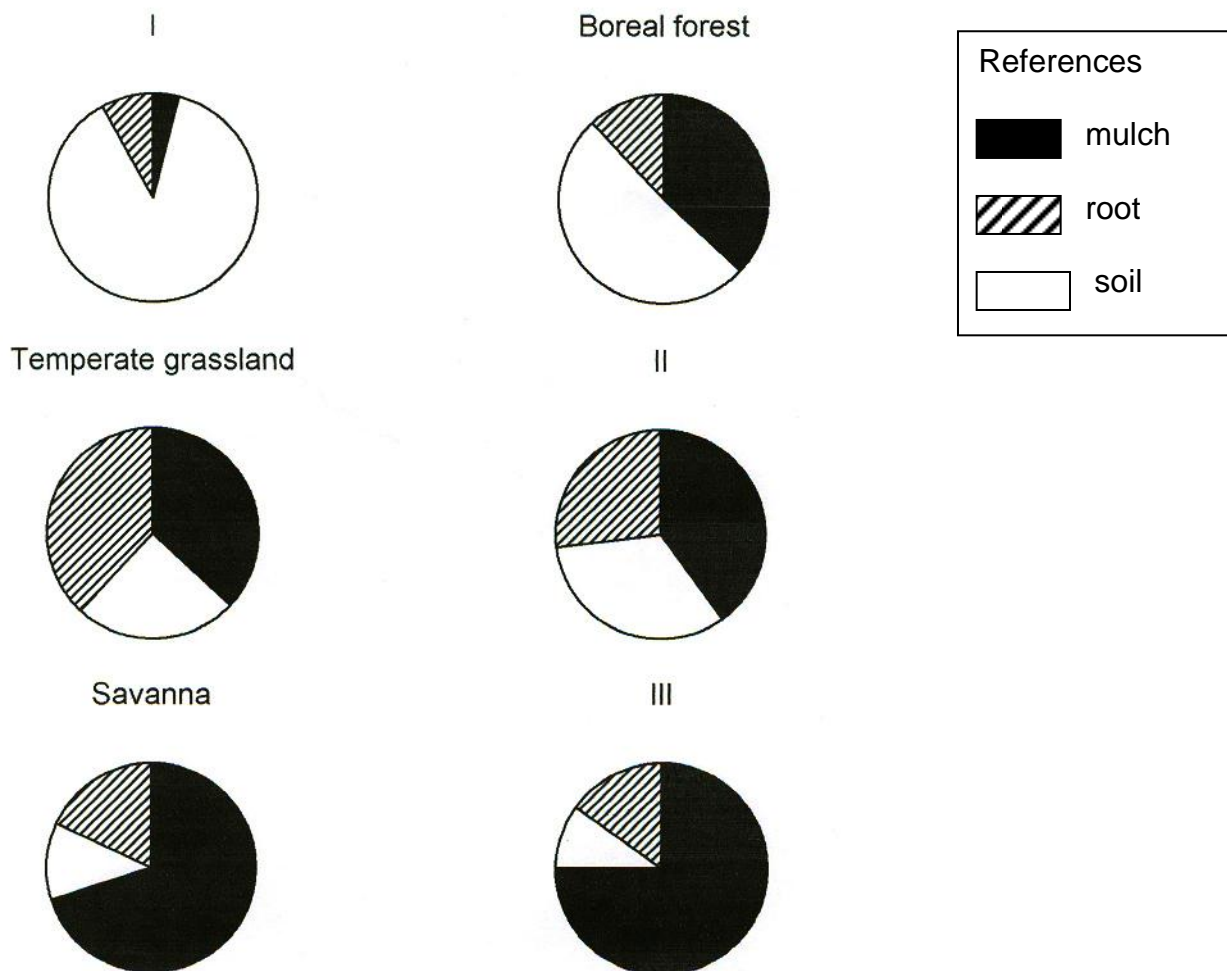
D) I and IV; III; and II.

E) I and III; II; and V.

66- Identify the organisms with mutualistic interaction between them, and the example representing this situation:

	Mutualistic interaction between	Example
A)	C1 C2	I
B)	C1 C2	II
C)	C2 C3	II
D)	E	III
E)	C1 C2	V

67- Organic matter decomposition depends in part on climatic factors such as temperature and precipitation. In the following schemes, the distribution of nitrogen in mulch, root, and soil for six different biomes is shown. Which biome is represented in each of the following figures: I, II, and III?



- A) I= Tundra, II= Temperate deciduous forest, III= Tropical deciduous forest.
 B) I= Tropical deciduous forest, II= Tundra, III= Temperate deciduous forest.
 C) I= Temperate deciduous forest, II= Tropical deciduous forest, III= Tundra.
 D) I= Tundra, II= Temperate deciduous forest, III= Tropical evergreen forest.

68- Which of the following statements are correct?

Statements

- I. The amount of nitrogen in living organisms is very small compared to the total quantity in the atmosphere.
- II. Less than 30% of the nitrogen available for plants comes from nitrogen-fixing bacteria or algae.
- III. The gaseous nitrogen cycle is global because it implies an exchange between the ecosystem and the atmosphere.
- IV. The input mechanisms of nutrients to an ecosystem are different from the output ones.
- V. The nutrients cycles can be studied introducing radioactive markers in natural or artificial ecosystems.

Answer

- A) I; II; and IV.
- B) II; III; and V.
- C) I; III; and V.
- D) III; IV; and V.
- E) II; IV; and V.

69- In Biology, dispersion refers to:

- A) the movements of organisms between populations.
- B) the movements of organisms within a population.
- C) the relative positions of the organisms to one another.
- D) A and B are true.
- E) B and C are true.

70 - Which of the following statements are true?

Statements

- I. The life table of a population does not change with the environmental conditions.
- II. To project the population growth when birth and mortality rates vary according to individual age, we must know the proportion of individuals in each age-class.
- III. The life table of a population varies according to the density of the population.
- IV. The age-class structure of a population is always an indicative of the temporal heterogeneity in individuals' recruitment.

Answer

- A) I, and III.
- B) I, and IV.
- C) II, and III.
- D) II, and IV.
- E) III, and IV.

BIOSYSTEMATICS

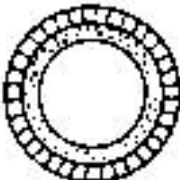
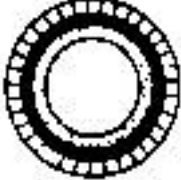
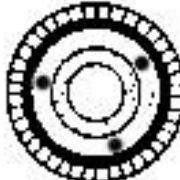


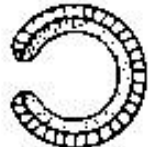

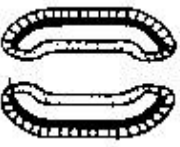
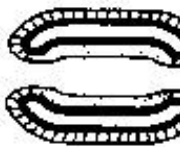
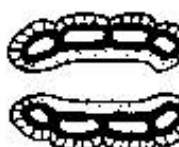
71- Development in marine molluscs may be characterized by:

- A) trochophore larva only.
- B) trochophore and veliger larva.
- C) direct development without larval state.
- D) all of them are correct.

72- Observe the following diagrams of invertebrates embryos illustrating the characteristics of the body plan (bauplan).

References

Endoderm  Mesoderm  Ectoderm 

Cross	I	II	III	IV	V
Transversal					
Longitudinal					
	Diploblastic	Triploblastic			
	No coeloms		pseudocoeloms	true coeloms	
	Incomplete or blind gut		Complete gut (Tube-within-a-tube)		
	Without segmentation			With segmentation (metameric)	

Select the correct sequence which corresponds to the Phyla represented with I, II, III, IV and V.

A)	Cnidaria	Platyhelmintha	Annelida	Nematoda	Arthropoda
B)	Cnidaria	Platyhelmintha	Nematoda	Arthropoda	Annelida
C)	Nematoda	Arthropoda	Platyhelmintha	Cnidaria	Annelida
D)	Annelida	Cnidaria	Arthropoda	Platyhelmintha	Nematoda

73- The following characteristics correspond to: Unicellular organisms, eukaryotic cell with micronuclei and macronuclei, asexual reproduction by transverse binary fission and sexual reproduction by conjugation. Most are free-living.

- A) Rhizopoda
- B) Apicomplexa
- C) Zoomastigophora
- D) Ciliophora

74- The main characteristics of the Asteraceae family are:

- A) calyx in the form of a pappus, sympetalous corolla.
- B) inferior ovary.
- C) seed separated from the pericarp.
- D) free filaments, fused anthers.
- E) all of them are true.

75- The Orchidaceae family present:

- A) superior ovary, three-carpellate, one loculed ovary.
- B) showy labellum. Pollen grains united in a mass.
- C) plants with terrestrial habitat only.
- D) androecium with two whorls of stamens of six stamens each.
- E) fruit siliqua, The embryo is surrounded by storage tissue.

76 - The flower parts in the Solanaceae are:

- A) calyx of 4 sepals, corolla of 4 petals, androecium of 6 stamens usually, parietal placentation.
- B) calyx of 5 sepals, corolla of 5 petals, androecium of 5 stamens usually, axile placentation.
- C) calyx of 5 sepals, corolla of 5 petals, androecium of 10 stamens usually, marginal placentation.
- D) calyx of 5 sepals, corolla of 5 petals, androecium of 4 stamens usually, axile placentation.
- E) perigon of 6 tepals, androecium of 6 stamens, axile placentation.

77- The Pinophyta are characterized by:

- A) seedlings with two cotyledons.
- B) anatropous ovule.
- C) double fertilisation.
- D) prothallus (primary endosperm) as storage tissue of the seed.
- E) high predominance of herbaceous species.

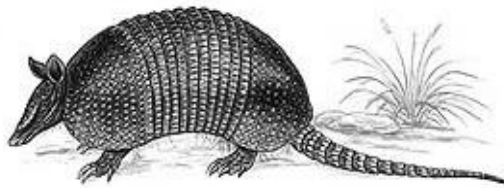
78- The Liliopsida are characterized by:

- A) a tap root system.
- B) typical netlike veins
- C) flower parts are usually in multiples of three.
- D) ring-like arrangement of vascular bundles.
- E) secondary growth.

ETHOLOGY

**** The following 2 questions are related to the mulita (*Dasypus hybridus*) behavior.**

To shelter and to look after its babies, the mulita (*Dasypus hybridus*) excavates cylindrical burrows where it builds its nest with vegetal matter, specially dry grasses (herbs).



79 - The mulitas avoid the overlapping of refuge and nestling areas by means of a fragrant sign: on moving into the burrow, they impregnate its roof with an oily and stinking liquid that is secreted by a gland placed in the back of the caparison at the pelvis level.

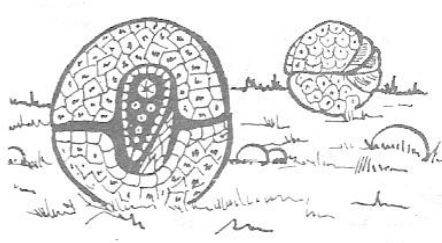
Therefore every adult mulita usually dwells into its own burrow -though sometimes the burrows may be occupied by several individuals. This behavior corresponds to:

- A) an altruistic behavior.
- B) a selfish or malicious behavior.
- C) a territorial behavior.
- D) an agonistic behavior.
- E) none of the previous ones.

80- The above mentioned behavior is adaptative and tends:

- A) to reduce the intraspecific competition.
- B) to ensure the most efficient use of the resources in a habitat.
- C) to control the population growth.
- D) to stimulate the dispersion of the individuals.
- E) all the previous ones are correct.

**** The armadillo commonly known as matabaco or ball quirquincho (*Tolypeutes matabaco*) adopts, sometimes, a typical position similar to a "ball" as you can see in the following figure; hence its name. In these cases, they draw in their feet and nose causing the exoskeleton plates of the body and head to fit tightly to each other.**



81- The armadillo exhibits this behavior when it faces a:

- A) sure hiding place.
- B) food source.
- C) possible predator.
- D) companion or a baby.
- E) fragrant mark of a companion.

82- Mating of *Recurvirostra avosetta*, a wading bird, is preceded by some peculiar movements. Both male and female clean their feathers nervously. After some time, the female takes a horizontal position (see picture) and this triggers the male to copulate.

The horizontal position of the female corresponds to:

- A) a conditioned reflex.
- B) a displacement activity.
- C) an innate response.
- D) a sign stimulus.
- E) the super normal releaser.

