

Biology

Instructions for examinees

- א. Duration of the exam: Two hours
- ב. Exam structure and breakdown of points:
This exam has two parts.
Part One — 50 points
Part Two — 50 points
Total — 100 points
- ג. Material that may be used during the exam:
A Hebrew-foreign language/foreign language-Hebrew dictionary.
- ד. Special instructions:
Write your answers in the answer booklet.

Write all of your rough work (notes, calculations, etc.) on separate pages of the answer booklet only.
Write the word "טיוטה" on the top of each of these pages.
If you write any sort of work outside the answer booklet, your exam may be disqualified!

Good Luck !

ביולוגיה

הוראות לנבחן

- א. משך הבחינה: שתיים.
- ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה שני פרקים.
פרק ראשון – 50 נקודות
פרק שני – 50 נקודות
סה"כ – 100 נקודות
- ג. חומר עזר מותר בשימוש:
מילון עברי-לועזי / לועזי-עברי.
- ד. הוראות מיוחדות:
את תשובותיך על השאלות כתוב במחברת הבחינה.
כתוב במחברת הבחינה בלבד, בעמודים נפרדים, כל מה שברצונך לכתוב בטיוטה (ראשי פרקים, חישובים וכדומה).
רשום "טיוטה" בראש כל עמוד טיוטה. רישום טיוטות כלשהן על דפים שמחוץ למחברת הבחינה עלול לגרום לפסילת הבחינה!

בהצלחה !

Questions

Part One (50 points)

Animal Behavior

There are four questions, 1-4, in Part One.

Answer three questions: Question 1 (required) (26 points) and two of the questions 2-4 (each question - 12 points).

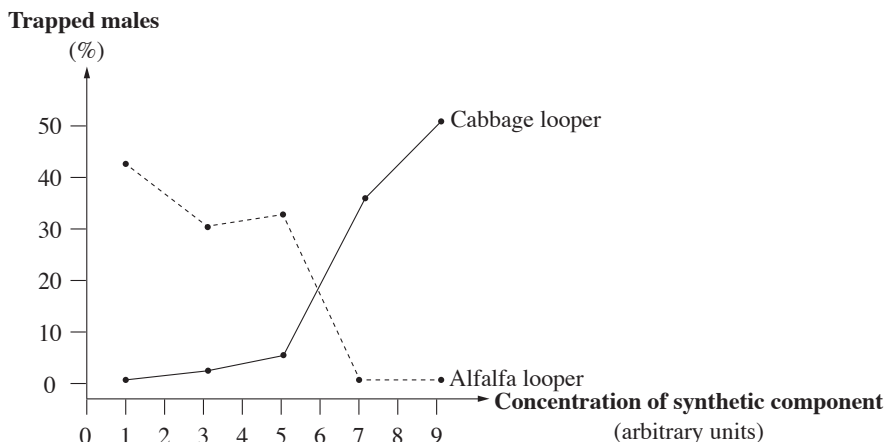
Answer Question 1 (**required**).

1. Researchers wanted to investigate the effect of a sex pheromone on the males of two species of moth (a type of butterfly): the cabbage looper moth [עש הכרוב] and the alfalfa looper moth [עש האספסת]. They discovered a certain component in the pheromones that females of both species secrete.

The researchers synthesized this component in the lab, and set up traps with different concentrations of the synthetic component. Next, they released males of both species and checked how many males were trapped.

The results of this experiment are shown in the graph below.

Effect of concentration of the synthetic component on percentage of male moths of both species that were trapped



(Based on A. Hefez, **Chemical Communication Between Animals**, Open University, 1986, p. 53)

- ⌘. What can we conclude from the graph about the effect of the synthetic component's concentration on its attraction for male moths of each species? (5 points)

(Note: This question continues on the next page.)

/continued on page 3/

- ג. (1) A sex pheromone is a means of conveying unique cues from the females to males of the same species.
What is the importance of this unique cueing to the survival of the species?
- (2) Using the results described by the graph, determine for each of the concentrations 1, 6, and 9 of synthetic component whether it allows the unique cue to be conveyed by the females to the males. Explain your reasoning in each case.
(8 points)
- א. In addition to the component tested in the experiment, the natural pheromone secreted by female cabbage looper moths contains five more components. It has been found that the natural pheromone from female cabbage loopers only attracts male cabbage loopers and not male alfalfa loopers. Suggest one explanation for this. (5 points)
- ד. In an additional experiment, researchers tested the effect of the age of female cabbage loopers on their ability to attract males.
- (1) What was the dependent variable in this additional experiment, and how can it be measured?
- (2) Name one factor that must be kept constant in the experiment, and explain why it is important to keep this specific factor constant.
(8 points)

Answer two of the questions 2-4.

2. Dolphins have a snout-like projection on the front of their heads (a rostrum). They use their rostrum to forage in the seaweed for small fish and crabs.
Scientists observed a behavior among Indian Ocean dolphins that was not seen in dolphins elsewhere: before a dolphin sets out to forage for food, it rips off a piece of marine sponge (a sea creature) and fits it over its rostrum. This protects its rostrum from injury so that the dolphin can dig deeper and more easily among the seaweed. Scientists hypothesize that a female discovered this method accidentally while playing, and the other dolphins learned from her.
- א. This behavior among dolphins is an example of tool use in animals.
Provide one more example of tool use in animals.
(4 points)

(Note: This question continue on the next page.)

- ב. The scientists hypothesize that the behavior observed in these dolphins is a learned behavior.

- (1) Provide two more examples from animals (except for humans): one example of a learned behavior, and one example of an innate behavior.
- (2) Sometimes it is difficult to know whether a behavior is learned or innate. One way to test this is by using an adoption experiment.
- Explain how the results of an adoption experiment can help determine whether a behavior is learned or innate.

(8 points)

3. א. Ibex are herd mammals. Two ibex kids were separated from their mothers at birth. One kid was left with its mother for a short while after birth and then taken away, and the other was taken away from its mother immediately after birth. After some time, each kid was returned to its mother. The female whose kid had been allowed to remain with her for a while resumed care of her kid, but the female whose kid had been taken away immediately, rejected her kid and did not care for it.

What is the name of the natural process that occurred in the mother whose kid was allowed to remain with her for a short while and that did not occur in the mother whose kid had been removed immediately? Explain the importance of this process to the kid.

(4 points)

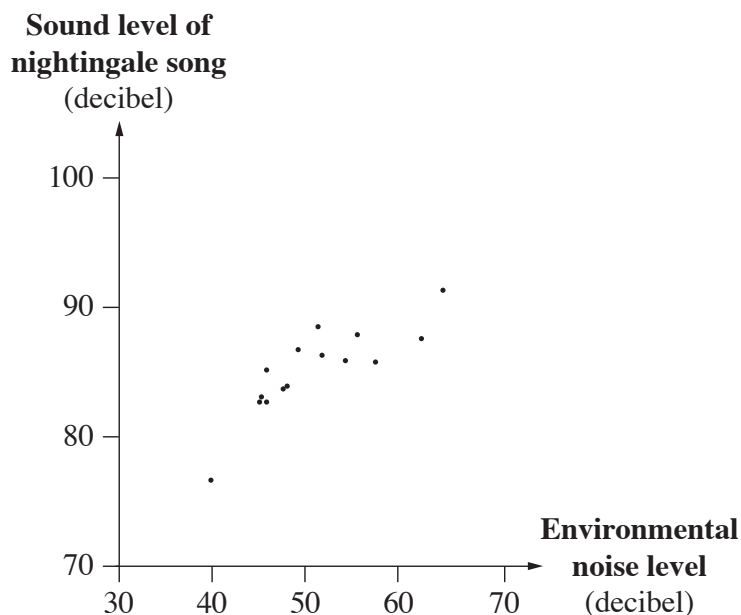
- ב. The reproductive strategy in ibex is the K strategy. Name one advantage and one disadvantage of this strategy compared with the r strategy.
- ג. During the courting season, before the breeding season, male ibex battle each other. The winner of the battles mates with the females in the herd. What is the possible benefit to the species of these battles between the males?

(4 points)

4. Researchers investigated the relationship between the sound level of song in male nightingales (a songbird) and the level of noise around them. The researchers measured the level of sounds produced by 15 individuals inhabiting different areas. The level of environmental noise in each of the areas was different. Each individual was measured in its natural habitat.

The results of this experiment are shown in the graph on the following page. Each point on the graph represents the average measurement for a specific individual.

Relationship between environmental noise and sound level of male nightingale vocalization



(Based on: H. Brumm, "The impact of environmental noise on song amplitude in a territorial bird". *Journal of Animal Ecology*, 16 April 2004. from: besjournal.onlinelibrary.wiley.com)

- א. (1) What can we conclude from the results shown on the graph?
- (2) Name one other environmental factor that can affect the sound level of a nightingale's song. Explain in what way this factor may impact the sound level of the bird's song.
(5 points)
- ב. (1) For what do birds use vocal communication (name two uses)?
- (2) Name one advantage and one disadvantage of vocal communication compared with visual communication.
(7 points)

Part Two (50 points)

From Seed to Seed

There are four questions, 5-8, in Part Two.

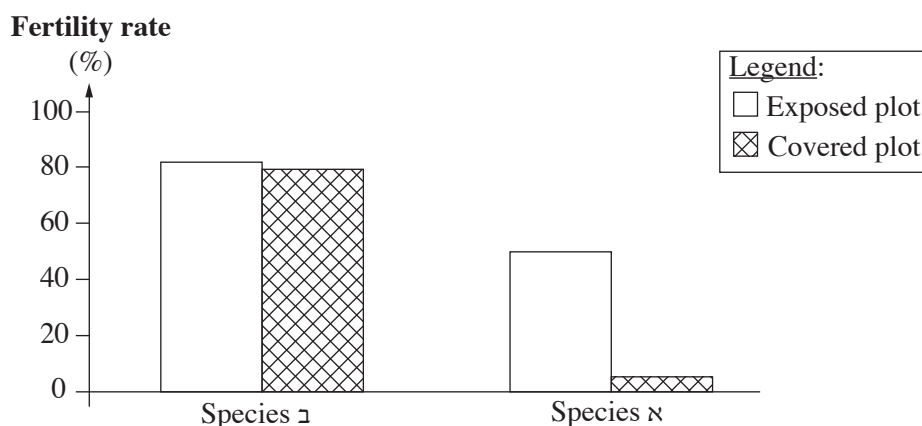
Answer three questions: Question 5 (required) (26 points), and two of the questions 6-8 (each question - 12 points).

Answer Question 5 (**required**).

5. A study examined the development of fruit in two species of plants, Species א and Species ב. Both species have colored flowers with nectaries [צופנים]. For this experiment, the researchers selected 40 plants from each species and grew them in two adjacent plots. Each plot was planted with 20 plants of Species א and 20 plants of Species ב. Abiotic conditions in both plots were optimal. One plot was covered with a dense mesh screen. The fertility rate for each of the plots was calculated by the percentage of flowers that developed a fruit.

The results are shown in the graph below.

Fertility rate of both plant species in the exposed plot and in the covered plot



- א. What is the research question in this experiment? (4 points)
- ב. Based on the graph, what are the independent variables in this experiment? (4 points)
- ג. Determine for each of the species א and ב whether it is mainly self-pollinated or mainly cross-pollinated. Explain your reasoning for each species. (6 points)
- ד. The researchers discovered that the average number of pollen grains per flower was much larger in Species א than in Species ב. Does this information support your answers in Item ג? Explain. (6 points)
- ה. Studies in biology are sometimes conducted outdoors and sometimes in the lab. Name one advantage of conducting an experiment **outdoors** and one advantage of conducting it in the **lab**. (6 points)

Answer two of the questions 6-8.

6. Potato plants can be propagated from potato seeds or from pieces taken from the tuber.

A farmer harvested pieces of tuber and some seeds from a potato plant. He planted the tuber pieces in one plot and the seeds in another plot. Growing conditions in both plots were the same. After the plants in both plots developed and grew tubers, the farmer collected tubers from 5 plants in each plot.

He weighed the tubers he had collected, and the results are shown in the table below.

Average tuber weight in each of the plots

Plot I		Plot II	
Plant	Average tuber weight in each plant (gram)	Plant	Average tuber weight in each plant (gram)
1	123	1	150
2	168	2	142
3	98	3	151
4	146	4	145
5	188	5	147

- א. (1) In which plot, I or II, is it likely that the farmer grew potatoes from seeds? Explain how you decided.
- (2) Another farmer grew potatoes the same way they were grown in Plot II. That year the potato plants contracted a plant disease and most of the crop was destroyed. Would the potatoes' chances of survival have been different if the farmer had grown these potatoes in the way they had been grown in Plot I? Explain.

(8 points)

- ב. Explain about one method of intervention in a plant's mechanisms of natural development that a farmer can apply to increase his yield. (4 points)

7. When a plant develops from a fertilized ovule, the cells differentiate and grow.

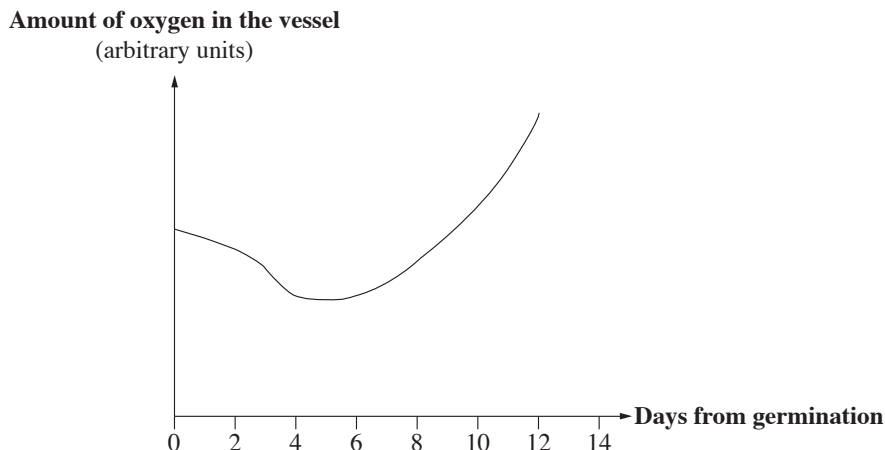
- א. (1) What is cell differentiation?
- (2) Name the organ that the fertilized ovule develops into and the organ that the ovary develops into.

(5 points)

- ב. Plant hormones affect plant development. Name one plant hormone and write about one effect it has on plants. (3 points)
- ג. Provide two examples of a plant tissue and/or organ. For each one, explain one connection between **structure** and **function**. (4 points)

8. Researchers germinated seeds in a closed vessel under optimal lighting conditions, and measured the amount of oxygen in the vessel for two weeks. The results of their measurements are shown in the graph below.

Amount of oxygen in the vessel containing germinating seeds



- א. (1) What is the process that caused the change in the amount of oxygen in the vessel during the first four days after germination began? Explain the importance of this process to germinating seeds.
- (2) On the fourth day the germinating seeds grew leaves. Use this fact to explain the results shown in the graph for days 4-6.
- (8 points)
- ב. The described experiment was conducted in the light. If it had been conducted in the dark, would its results have been similar to the ones described in the experiment above? Explain. In your answer, discuss the experimental results expected on days 0-4 and on days 6-12.
- (4 points)

Good Luck!

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בהצלחה!

זכות היוצרים שמורה למדינת ישראל
אין להעתיק או לפרסם אלא ברשות משרד החינוך