

Biology

3 points

Instructions for examinees

א. Duration of the exam: Three hours

ב. Exam structure and breakdown of points:

This exam has four parts.

Part One — 30 points

Part Two — 24 points

Part Three — 24 points

Part Four — 22 points

Total — 100 points

ג. Material that may be used during the exam:

Hebrew-foreign language / foreign language-

Hebrew dictionary

ד. Special instructions:

For the questions in Part I, mark your answers
in the answer sheet found at the end of the
answer booklet (page 19).

For the questions in the other three parts, write
your answers in the answer booklet.

Write all of your rough work (calculations, notes,
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 test may be disqualified!

Good Luck!

ביולוגיה

3 יחידות לימוד

הוראות לנבחן

א. משך הבחינה: שלוש שעות.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה ארבעה פרקים.

פרק ראשון — 30 נקודות

פרק שני — 24 נקודות

פרק שלישי — 24 נקודות

פרק רביעי — 22 נקודות

סה"כ — 100 נקודות

ג. חומר עזר מותר בשימוש:

מילון עברי-לועזי / לועזי-עברי

ד. הוראות מיוחדות:

את התשובות על הסעיפים בפרק הראשון יש

לסמן בתשובון שבסוף מחברת הבחינה

(עמוד 19).

את התשובות על השאלות בשלושת הפרקים

האחרים יש לכתוב במחברת הבחינה..

כתוב במחברת הבחינה בלבד, בעמודים נפרדים,

כל מה שברצונך לכתוב כטיוטה (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 (30 points)

Part One consists of one question that contains the items א to טו.

You must answer all of the items. If you answer at least 13 of the items correctly, you will receive all 30 points.

Question 1 (30 points)

Four possible answers are presented for each item. Choose the most appropriate answer for each item.

- * Mark the answer you have chosen on the answer sheet at the end of the test booklet (page 19).
- * For each item, draw an ✕ in pen in the box under the number (1-4) that represents the answer you chose.

Example:

טו. Which disease is carried by mosquitoes?

1. jaundice
2. rubella
3. malaria
4. whooping cough

In this case, you would mark your answer on the answer sheet as follows:

4	3	2	1	טו.
☐	☒	☐	☐	

- * Draw only one ✕ for each item.
- * To erase an answer, fill in the entire square like this: ■ .
- * You may not use White-Out to erase answers.

Note: In order to limit the need to erase answers on the answer sheet, we recommend that you first mark the correct answers inside the answer booklet itself and only later enter them into the answer sheet.

Answer all of the items, א to טו.

א. Every living cell has:

1. mitochondria
2. a cell wall
3. cytoplasm
4. a nucleus

ב. Green plants are defined as autotrophs because they:

1. are nourished by materials that originate in the soil
2. produce organic substances through photosynthesis
3. carry out respiration only at night
4. emit oxygen during the night

ג. A decrease in the amount of platelets in the blood will immediately cause:

1. an increase in blood pressure
2. an impaired ability to produce antibodies
3. slower clotting
4. impaired transport of oxygen

ד. Cells in a certain person's pancreas produce the protein insulin, but that same person's white blood cells do not produce insulin.

What is the reason for this?

1. The DNA that codes for insulin is found only in cells in the pancreas.
2. The DNA that codes for insulin is also found in white blood cells, but is not expressed in those cells.
3. White blood cells destroy the DNA that codes for insulin.
4. No proteins are produced in white blood cells.

/continued on page 4/

- ה. Which of the examples below does not describe the adaptation of animals or plants to changing environmental conditions?
1. The green leaves of geophytes (plants that have bulbs or corms) wilt and dry up when summer comes.
 2. Annual plants complete their life-cycle over the winter and spring.
 3. Snails seal the openings of their shells when summer comes.
 4. The stick-bug [מקלון] is an insect that lives on plants and whose body looks like a thin twig.
- ו. What will happen to a person's body if the environmental temperature falls very low?
1. The blood vessels in his skin will expand greatly.
 2. The blood vessels in his skin will contract greatly.
 3. He will sweat.
 4. The temperature of his internal organs will drop significantly.
- ז. The intensity of photosynthesis may increase as a result of:
1. an increase in the concentration of CO_2
 2. strong wind
 3. a decrease in humidity
 4. an increase in the concentration of oxygen
- ח. All of the hormones in the human body:
1. are secreted directly to the target cells and affect those cells
 2. affect only target cells that have corresponding specialized receptors
 3. are secreted into the blood and affect all of the cells of the body
 4. increase the metabolic rate of the target cells
- ט. A person who is generally in good health came down with a disease caused by bacteria. Which of the following probably occurred in his body?
1. an increase in the number of red blood cells
 2. an increase in the number of white blood cells
 3. a decrease in the number of red blood cells
 4. a decrease in the number of white blood cells

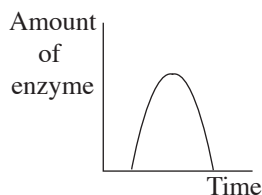
י. Which system coordinates the activities of the different systems of the human body?

1. the endocrine system [מערכת ההפרשה הפנימית]
2. the digestive system
3. the immune system
4. the respiratory system

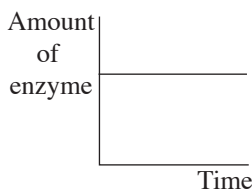
יא. The hereditary material in a cell is encoded:

1. in proteins located in the cytoplasm
2. in the protein in the cell membrane
3. in transfer RNA located in the cytoplasm
4. in DNA in the nucleus

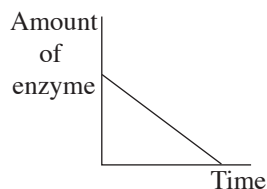
יב. Which one of the graphs below describes the change in the amount of enzyme over the course of an enzymatic reaction?



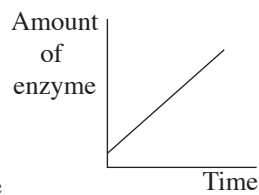
4



3



2



1

יג. In cellular respiration:

1. All of the energy produced is used by the cell.
2. All of the energy produced is emitted as heat energy.
3. Some of the energy produced is used by the cell and some is emitted as heat.
4. No energy is produced; energy is only consumed.

יד. Animals and plants that live on dry land need to cope with a unique problem. What is this problem?

1. difficulty absorbing food from the environment
2. evaporation of water to the environment
3. high light intensity
4. predation [טריפה]

טו. There is a reciprocal relationship [יחסי גומלין] between two organisms that can be defined as mutual symbiosis.

We can assume that this reciprocal relationship:

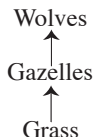
1. has a negative effect on each of the two organisms
2. has a positive effect on one of the organisms and a negative effect on the other
3. has a positive effect on each of the two organisms
4. does not affect either organism

Part Two (24 points)

Part Two is made up of five questions, 2-6, on different core topics.

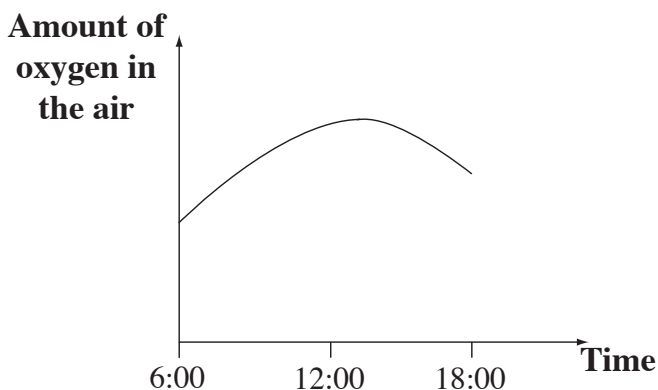
Choose three of these questions that you want to answer, and write your answers in the **answer booklet** (each question is worth 8 points).

2. If most of the wolves are killed off by a disease, what will happen to the other members of the food chain shown below? Explain.



3. Cigarette smoke contains carbon monoxide (CO), which strongly binds hemoglobin: 250 times more tightly than oxygen binds hemoglobin. Explain why heavy smokers have trouble performing intense physical activities.
4. Researchers grew green plants in a transparent greenhouse on a clear summer day. They measured the amount of oxygen in the air in the greenhouse over 12 hours (from 6:00 in the morning to 18:00 in the evening).

The graph below shows the collected data.



- א. Explain the data presented in the graph. (4 points)
- ב. How would a similar graph for the night-time hours look? Explain your answer. (4 points)

5. The human circulatory system includes arteries, veins and capillaries.
- א. In which of these blood vessels does gas move from the blood into cells? (3.5 points)
 - ב. What makes the type of blood vessel that you named suitable for gas exchange? (4.5 points)
6. Explain why living cells are destroyed when they are heated to a high temperature.

Part Three (24 points)

Part Three includes questions on three different topics.

Choose two topics that you studied and answer three questions on each of those topics, according to the directions given for each topic. Write your answers **in the answer booklet**.

(Each topic is worth 12 points; the point value of each item/question is specified at its end.)

Topic I — Animal Behavior

Answer three questions: Question 7 (required), one of the questions 8-9 and one of the questions 10-11.

Answer Question 7 (required).

7. Common rats (a rodent) that live in pine groves have a technique for opening pine cones and removing the seeds from those cones. Researchers conducted an adoption experiment to learn how the offspring of these rats learn how to open pine cones. The researchers took two groups of mature female rats: Group א — rats that do not open pine cones; and Group ב — experienced rats that open pine cones. All of the rats were mothers of young pups. Each rat was put into her own cage and there were pine cones in each cage. Along with the mother rat, four of her own pups and four pups from a mother rat from the other group were put into each cage.

The experimental set-up and the results are presented in the table below.

Result	Pups	Mothers	Group
None of the pups opens pine cones.	4 pups that belong to the mother in the cage + 4 pups that belong to a mother that opens pine cones	Mothers that do <u>not</u> open pine cones	א
All of the pups open pine cones.	4 pups that belong to the mother in the cage + 4 pups that belong to a mother that does not open pine cones	Mothers that open pine cones	ב

- א. Does the cone-opening behavior have a hereditary component? Explain your answer based on the results of the experiment. (2 points)
- ב. What type of learning is described above? Explain the characteristics of this type of learning. (2 points)

Answer one of the questions 8-9.

8. א. Different species of cicadas (a type of insect) live in the same enclosure. Each species makes its own unique chirping sounds. What is the significance of the fact that each species has its own unique sound? (2.5 points)
- ב. Bring an example of vocal communication of a different animal species. Write down the name of the animal and the message that is transmitted. (1.5 points)
9. א. What is the importance of filial imprinting [החתמת עקיבה]? (2.5 points)
- ב. In which species of birds would we expect to find filial imprinting: species that have גוזלים or species that have אפרוחים? Explain your answer. (1.5 points)

Answer one of the questions 10-11.

10. Among spiders of the genus *Pisaura* [ענבלן], the male offers an insect wrapped in web to the female as a mating gift.
- א. Explain one way in which this behavior is advantageous for the female and one way in which it is advantageous to the male. (2.5 points)
- ב. Bring an example of a mating gift among other animals (excluding humans, spiders and insects). (1.5 points)
11. א. Explain why, among many animal species, the females are more selective than the males when it comes to choosing a mate. (1.5 points)
- ב. What are two different characteristics according to which females chooses their mates? Bring an animal example for each of these characteristics. (2.5 points)

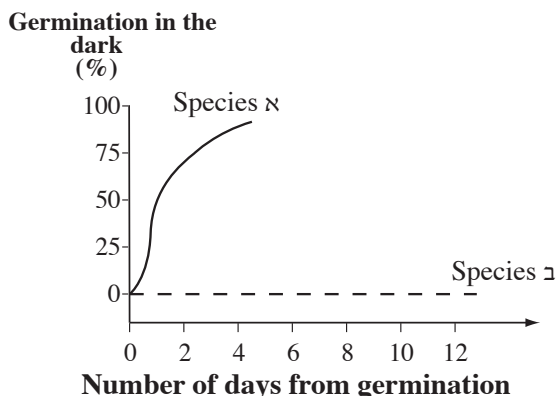
Topic II — From Seed to Seed

Answer three questions: Question 12 (required), one of the questions 13-14 and one of the questions 15-16.

Answer Question 12 (required).

12. Seeds of two plant species, א and ב, were soaked in water for 9 hours.

Afterwards, they germinated in the dark. The germination rates of the two species are described in the graph below.



א. Based on the graph, what can we conclude about the germination of the seeds of Species א and ב? (1.5 points)

ב. Plants need light in order to grow, but seeds do not usually need light in order to germinate.

Explain why light is not usually necessary for the germination of seeds. (2.5 points)

Answer one of the questions 13-14.

13. Arrange the concepts below in the order in which they occur:

distribution of seeds [הפצת זרעים], pollination [האבקה], meiosis [מיوزה], fruit development [התפתחות פרי], fertilization [הפריה]. (4 points)

14. An onion plant reproduces in two different ways:

- through small bulbs that develop on the mature bulb
- through the production of seeds.

Describe two differences between these two methods of reproduction. (4 points)

Answer one of the questions 15-16.

15. The spotted arum plant [לֹחַ מְנוֹמֵר] has a large inflorescence [תַּפְרֹחַת] that includes both male and female unisexual flowers [פְּרָחִים חֵד-מִינִיִּים].

During the flowering season, in the field you can find inflorescences at different phases of flowering.

In all arum plants, the female flowers in an inflorescence bloom earlier than the male flowers. The male flowers do not open until after the female flowers have wilted.

What method of pollination does this plant use: self-pollination or cross-pollination? Explain your answer based on the information given above.
(4 points)

16. א. Name two ways in which seeds are distributed. (1.5 points)

ב. What characterizes the seeds distributed in each of the ways you noted for Item א?

In your answer, note one characteristic for each method of distribution.
(2.5 points)

Topic III — Microorganisms

Answer three questions: Question 17 (required), one of the questions 18-19 and one of the questions 20-21.

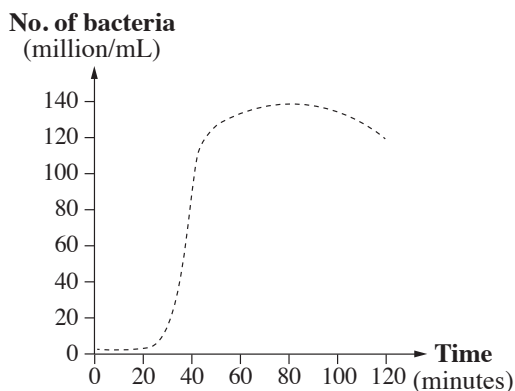
Answer Question 17 (required).

17. Ships that transport petroleum sometimes leak petroleum into the ocean, which causes a great deal of harm to the environment and to organisms that live in the ocean. Petroleum is an organic material that most bacteria cannot break down.

Researchers have identified a species of bacteria that can break down petroleum. They grew these bacteria in a container that contained seawater and petroleum and monitored the number of bacteria and amount of petroleum in the container over several hours.

The change in the number of bacteria is described in the graph below.

Change in the No. of Bacteria Over Time



Over the first 20 minutes of the experiment, the amount of petroleum did not change. At Minute 20, the amount of petroleum began to decrease.

Based on the changes in the number of bacteria described in the graph, explain the changes in the amount of petroleum over the course of the experiment. (4 points)

Answer one of the questions 18-19.

- 18. א.** When cucumbers are put into a dilute salt solution, after several days, the cucumbers will have become pickled and the solution in which they have been kept will have turned from clear to cloudy.
Explain why the solution becomes cloudy. (1.5 points)
- ב.** Describe a method used to preserve food and explain the biological principle on which that method is based. (2.5 points)
- 19.** In the wine industry, crushed grapes are put into containers that are kept closed for a certain period of time.
- א.** What is the name of the process used to produce wine? (1.5 points)
- ב.** Describe the wine production process. In your answer, note the starting material and products of this process. (2.5 points)

Answer one of the questions 20-21.

- 20. א.** Name one similarity between bacteria and viruses and two differences between bacteria and viruses. (1.5 points)
- ב.** Briefly describe the life-cycle of a virus (bacteriophage) that attacks a bacterial cell and kills the bacterium (lytic cycle). (2.5 points)
- 21.** Microorganisms play a unique and central role in the recycling of materials in nature.
- א.** Bring two examples of processes in which materials are recycled in nature. (1.5 points)
- ב.** Choose one of the processes you mentioned for Item א and explain the importance of the bacteria in that process. (2.5 points)

Part Four (22 points)

In Part Four, there are two passages, I-II.

Choose one of the passages and answer all of the questions for the passage that you chose. Write your answers in the **answer booklet**.

(The point value of each question is given at its end.)

Passage I — Year of the Bat

The UN declared 2011 the Year of the Bat and, over the course of that year, activities were carried out throughout the world to protect these flying mammals. Today, there are more than a thousand species of bats in the world, but about half of those species are in danger of extinction as a result of



Fruit bat. Photo: Yuval Bar

the pollution and destruction of their habitats, as well as efforts that were made in the past to exterminate them because they were thought to transmit diseases and cause agricultural damage. Bats are the only flying mammals. They are active at night and the eyesight of many bats is undeveloped. During the day, they hide in dark, damp places such as caves, ruins and tree trunks. Most species live in large groups of hundreds of individuals or more. Bats weigh less than other mammals of similar size. The wing of a bat is very large relative to its body and is made of a flexible membrane that connects its limbs with its tail. It has a relatively thin layer of fat and its fur is short.

Bats consume large quantities of food since their flying requires a lot of energy. They digest their food quickly and quickly excrete surplus undigested food so that it does not weigh them down as they fly.

Bats have a very well-developed sense of orientation, which allows them to be active at night. Bats make very high-pitched sounds (most of which are out of the range of human hearing) and their ears pick up the sounds that echo off objects in their path. This allows bats to find their way around the surrounding environment and to locate prey and hazards. Certain species have an orientation mechanism that is so well-developed they can fly between threads that are only 1 millimeter in diameter.

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

/continued on page 16/

There are 32 species of bats living in Israel. Most of these species feed on insects, apart from one of them, the common fruit bat. Fruit bats prefer very ripe fruit. Nowadays, fruits are harvested before they ripen, but in the past, fruit was harvested when it was already ripe and these bats damaged the crops before they could be harvested. For that reason, at the time, extermination activities were carried out in caves to reduce the Israeli fruit bat population. These actions also harmed populations of insect-eating bats that lived in the same caves. These bats eat insects that are agricultural pests. In one night, this type of bat can eat almost its own weight in insects.

Today, actions have been taken to protect bat populations. It is prohibited to enter the caves in which bats sleep and, in urban areas, sleeping boxes have been set up, in which female bats can raise their young.

If you chose Passage I, answer the five questions 22-26.

- 22.** Name two reasons why bats are in danger of extinction and describe one thing that is being done to alleviate this danger. (4 points)
- 23.** One could say that a bat "sees" with its ears. Explain this sentence. (4 points)
- 24.** Today, fruit bats are not considered agricultural pests. Explain why. (4 points)
- 25.** Explain why extermination efforts in bat caves are bad for agriculture. (5 points)
- 26.** Explain how the body and lifestyle of the bat are adapted for flight. In your answer, refer to two structural (morphological) adaptations and one physiological or behavioral adaptation. (5 points)

Passage II — Bitter Can Be Good!

Glucose is a monosaccharide that serves as a source of readily available energy and is important for the functioning of all of the cells of the body. The level of glucose in the blood of a healthy person is regulated by the hormone insulin. The level of glucose in the blood of diabetics is usually higher than normal. High levels of glucose in the blood can cause serious harm. In the short term, high levels of glucose can cause fatigue, blurred vision and weakness. In the long term, high glucose levels can increase the likelihood of developing diseases of the heart and blood vessels, and also damage the eyes, nervous system, kidneys etc.

There are several types of diabetes, the most common being Type 1 diabetes and Type 2 diabetes. In Type 1 diabetes, the pancreas barely produces any insulin. This disease usually develops in young people. In Type 2 diabetes, the activity of the insulin receptors on the cell membranes is impaired. This disease generally develops among older people. Most of the people suffering from diabetes today have Type 2 diabetes.

The relative number of diabetics in the population is very high and increasing steadily. Research has shown that there is a relationship between the modern lifestyle, characterized by low levels of physical activity and a diet rich in carbohydrates, sugars and fats, and the increase in the incidence of Type 2 diabetes.

The regulation of glucose levels in the blood is very important. Diabetics use medication and behavioral changes to regulate their glucose levels. Maintaining a healthy lifestyle and normal weight allows for the proper regulation of glucose in the blood and decreases the likelihood of developing Type 2 diabetes. The steady increase in the number of diabetics is very troubling and many researchers are studying this disease in an effort to find an effective treatment for it.

Researchers at the Hebrew University of Jerusalem and Harvard University in the US studied the medicinal properties of the substance naringenin, which is found in grapefruit and gives that fruit a bitter taste. One of these medicinal properties is the ability to regulate the level of glucose in the blood.

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

In experiments carried out in rats, researchers examined the efficacy of naringenin as a nutritional supplement. They found that the absorption of naringenin in the intestine is high only when it is bound to another substance (i.e., when it is conjugated). The blood glucose levels of rats that were given conjugated naringenin about half an hour before a meal rich in fats and sugars fell after the meal more quickly than those of rats that had not received the conjugated naringenin.

The effect of naringenin is still being examined and its effect in humans has not yet been tested. The researchers hope that this research will pave the way for the improved future treatment of diabetes.

If you chose Passage II, answer the five questions 27-31.

27. Based on the passage, name two factors that can increase the chances of developing Type 2 diabetes. (4 points)
28. A diet rich in carbohydrates is dangerous for people suffering from Type 2 diabetes. Explain why. (5 points)
29. People with Type 1 diabetes lack insulin. Based on what you learned, explain the role of insulin in regulating the level of sugar in the blood. (5 points)
30. Based on the experiment described in the passage, what is the effect of giving conjugated naringenin to rats? (4 points)
31. Explain the advantage of giving conjugated naringenin as opposed to naringenin alone. (4 points)

Good Luck!

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בהצלחה!

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