State of Israel
Ministry of Education
Exam Type: *Bagrut*
Exam date: Summer 2023
Exam number: 43381
English translation (3)

מדינת ישראל
משרד החינוך
סוג הבחינה: בגרות
מועד הבחינה: קיץ תשפ"ג, 2023
מספר השאלון: 43381
תרגום לאנגלית (3)

Biology

Questions and Analysis of Scientific Research in the Core Topic Areas
Questions on Topics of In-Depth Study

ביולוגיה

שאלות וניתוח מחקר מדעי
בנושאי הליבה
שאלות בנושאי ההעמקה

Instructions

א. Duration of the exam: Three hours

ב. Exam structure and breakdown of points:
This exam has four parts.
Part One – 32 points
Part Two – 35 points
Part Three – 18 points
Part Four – 15 points
Total – 100 points

ג. Material that may be used during the exam:
A Hebrew–foreign language/foreign language–Hebrew dictionary

ד. Special instructions:
Mark your answers to Part One on the answer sheet at the end of the answer booklet (page 23).
Answer the questions in Part Two, Part Three, and Part Four in the answer booklet.

Write in the answer booklet only.
Write the word "טיוטה" at the top of each of draft page.
If you write any draft material on paper outside the answer booklet, your exam may be disqualified.

Good Luck!

הוראות

א. משך הבחינה: שלוש שעות.

ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה ארבעה פרקים.
פרק ראשון – 32 נקודות
פרק שני – 35 נקודות
פרק שלישי – 18 נקודות
פרק רביעי – 15 נקודות
סך הכול – 100 נקודות

ג. חומר עזר מותר בשימוש:
מילון עברי–לועזי / לועזי–עברי.

ד. הוראות מיוחדות:
את התשובות על השאלות בפרק הראשון יש לסמן בתשובון שבסוף מחברת הבחינה (עמוד 23).
את התשובות על השאלות בפרק השני, בפרק השלישי ובפרק הרביעי יש לכתוב במחברת הבחינה.

יש לכתוב במחברת הבחינה בלבד. יש לרשום "טיוטה" בראש כל עמוד המשמש טיוטה. כתיבת טיוטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

בהצלחה!

Questions

Part One (32 points)

Part One has 20 questions, 1–20.

You must answer all of the questions. If you answer at least 15 questions correctly, you will receive all 32 points.

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

* Mark the answer you have chosen on the answer sheet at the end of the answer booklet (page 23).
* For each question, draw an **×** in pen in the box under the letter (א–ד) that represents the answer you chose.

Example:

47. Which disease is carried by mosquitoes?

א. jaundice

ב. rubella

ג. malaria

ד. whooping cough

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

	ד	ג	ב	א	
47.	☐	☒	☐	☐	

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

/continued on page 3/

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

Answer all of the questions 1–20.

1. Where in the cell is ATP produced?

א. in the ribosomes and in the mitochondria

ב. in the nucleus and in the ribosomes

ג. in the mitochondria and in the cytoplasm

ד. in the nucleus and in the cytoplasm

2. What is a seed's direct source of energy for germination?

א. minerals in the soil

ב. oxygen in the soil

ג. sunlight

ד. organic substances in the seed

3. What do a plant cell, an animal cell, and a bacterial cell have in common?

א. In all three, the genetic material is separated from the cytoplasm by a membrane.

ב. All three have the same sequence of nucleotides in their DNA.

ג. All three are capable of photosynthesis and of cellular respiration.

ד. In all three, proteins are built.

4. Runners in a race sweat even when the temperature around them is low. What causes this?

א. increased cellular respiration in muscle cells

ב. increased blood flow to the brain

ג. reduced blood flow to the skin

ד. increased secretion of erythropoietin

/continued on page 4/

5. A student tested how much lactic acid was produced over 24 hours in test tubes that contained muscle cells, at several different temperatures and at two concentrations of oxygen. At the beginning of the experiment, all the test tubes contained the same number of cells and the same concentration of glucose.

The experiment set-up is shown in the table below.

Test tube	**Temperature** (^{o}C)	**Oxygen concentration** (%)
A	10	20
B	19	20
C	37	5
D	75	5

In which test tube did the student obtain the most lactic acid?

א. In test tube A

ב. In test tube B

ג. In test tube C

ד. In test tube D

6. Which is the correct statement about energy transformation (conversion) in living organisms?

א. Heat energy is converted into chemical energy and light energy.

ב. Chemical energy is converted into other chemical energy and into heat energy.

ג. Heat energy is converted into chemical energy.

ד. Chemical energy is converted into light energy.

7. The left side of someone's heart muscle has become very weak. What could happen as a result?

א. The blood pressure in their aorta will rise.

ב. Their cardiac output will increase.

ג. The right side of their heart will pump blood to the aorta.

ד. Their stroke volume [נפח הפעימה] will decrease.

8. Corn plants that absorb large amounts of nitrogen compounds from the soil grow faster than corn plants that absorb small amounts of nitrogen compounds from the soil. What could be the reason for this?

א. A high concentration of nitrogen in the plant cells enables increased production of proteins.

ב. A high concentration of nitrogen in the plant cells enables a larger amount of nitrogen to be converted to glucose.

ג. A high concentration of nitrogen in the root cells causes more water to leave the cells.

ד. A high concentration of nitrogen in the cells causes the plant to reduce its rate of photosynthesis.

/continued on page 5/

9. A red blood cell travels through the bloodstream from the right hand to the right foot. Through which organs must it pass on its way?

א. the diaphragm and the lungs

ב. the heart and the lungs

ג. the heart and the kidneys

ד. the kidneys and the leg muscle

10. Scientists tested populations of bacteria in different soils. They found that there was a higher percentage of petroleum-digesting bacteria in soils with a high petroleum content than in soils that were low in petroleum. What could explain this?

א. In a petroleum-rich environment, only traits that are beneficial to survival are hereditary.

ב. In a petroleum-rich environment, over time, the bacteria adapted to using petroleum as a source of food.

ג. In a petroleum-rich environment, the bacteria that were adapted to digesting petroleum reproduced more than other bacteria.

ד. In a petroleum-rich environment, petroleum-digesting bacteria multiply in order to protect the environment.

11. In which of the following processes do enzymes participate?

א. an antibody binding to an antigen

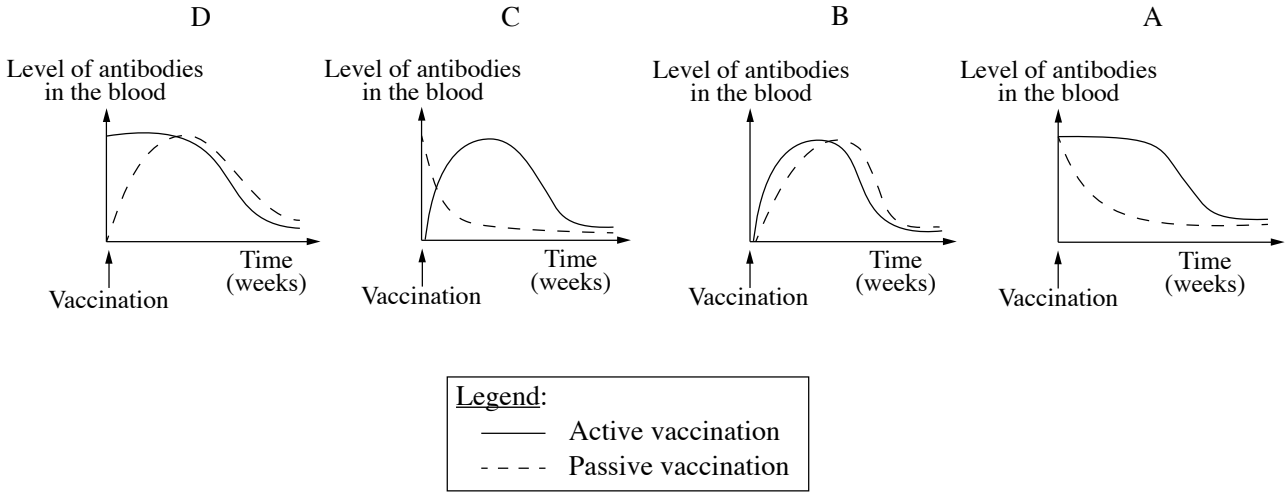
ב. photosynthesis

ג. oxygen entering a cell

ד. osmosis

/continued on page 6/

12. Which of the following diagrams A–D correctly describes the levels of antibodies for a certain antigen after a passive vaccination and after an active vaccination?



א. A

ב. B

ג. C

ד. D

13. An animal cell was placed in a solution that contained a toxic substance. The molecules of the toxic substance did not enter the cell.

What might be the explanation for this?

א. The concentration of the toxic substance in the cell was lower than its concentration in the solution.

ב. The selective permeability of the membrane prevents substances that the cell does not need from entering the cell.

ג. The molecules of the toxic substance are very large and are insoluble in fat.

ד. Only non-harmful molecules pass through the membrane.

14. Which statement is correct for viruses but incorrect for bacteria?

א. can cause diseases

ב. contain only one type of genetic material

ג. can multiply rapidly

ד. we can manufacture vaccines to protect against them

15. The urine of a healthy person does not contain glucose. What causes this?

א. Glucose is absorbed from the nephron back into the blood.

ב. Glucose does not pass from the blood to the nephron.

ג. Glucose that reaches the kidney is converted to urea.

ד. Glucose is essential, so it is not discharged in urine.

/continued on page 7/

16. Why are there producers and not consumers at the base of all ecological pyramids?

א. because only producers produce oxygen from water and minerals

ב. because only producers produce oxygen from carbon dioxide

ג. because only producers produce organic substances from inorganic substances

ד. because only producers produce inorganic substances from water and oxygen

17. Which statement about the human respiratory system is correct?

א. When the diaphragm muscle contracts it increases the volume of the chest cavity.

ב. When inhaling, the volume of the lungs increases because air enters them.

ג. Oxygen passes from the alveoli to the blood by active transport.

ד. Changes in the composition of the blood do not affect breathing rate.

18. What is characteristic of the random events that affect the composition of populations?

א. They take place regardless of natural selection processes.

ב. They always cause an increase in the incidence of traits that are beneficial in that environment.

ג. They mainly affect large populations.

ד. They always cause a decline in the fitness of the individuals in the population.

19. How do platelets [טסיות] help maintain homeostasis after an injury?

א. They prevent the destruction of red blood cells.

ב. They prevent damage to the arteries.

ג. They prevent the formation of blood clots.

ד. They prevent blood pressure from decreasing.

20. Students conducted an experiment with two closed bags made of a selectively-permeable membrane that is similar in properties to the cell membrane.

They put water and glucose in Bag A , and water and starch in Bag B . Both bags were placed in a container of distilled water.

A few minutes later, Bag A swelled up, and Bag B did not swell up.

Which of the possibilities א–ד might explain the result in Bag B ?

א. Storage compounds [חומרי תשמורת] pass through the cell membrane.

ב. Storage compounds do not dissolve in water.

ג. Storage compounds are composed of disaccharides [דו־סוכרים].

ד. Storage compounds break down in distilled water.

Note: Mark your answers on the answer sheet on page 23 at the end of the answer booklet.

/continued on page 8/

Part Two (35 points)

Part Two has seven questions, 21–27.

Choose four questions and write your answers in the **answer booklet** (each question — 8.75 points).

21. א. Testers drew a blood sample from someone to determine his blood type. The testers added Antigen A antibodies to one drop of the blood sample and Antigen B antibodies to another drop of the blood sample.

The red blood cells clumped together (agglutinated) only in the blood to which they had added Antigen B antibodies.

(1) What is this person's blood type?

(2) May this person donate blood to a person whose blood type is O ? Explain.

(4.75 points)

ב. A woman whose blood type is A and a man whose blood type is AB have a child whose blood type is B .

Give the blood type genotype for each family member. (4 points)

22. The enzyme carbonic anhydrase is found on the membrane of red blood cells. This enzyme catalyzes the production of carbonic acid from water and carbon dioxide (CO_2) that are present in the plasma.

א. The rate of carbonic anhydrase activity in muscles during exertion is higher than its rate of activity in muscles at rest.

Explain the reason for the difference in the enzyme's rate of activity. Discuss the concentration of CO_2 in your answer. (3 points)

ב. **(1)** Under certain conditions, the activity of the enzyme carbonic anhydrase in the blood can be disrupted. Explain why reduced activity of the enzyme can interfere with the normal **transport** of CO_2 in the blood.

(2) The activity of carbonic anhydrase affects the acidity level (pH) of the blood.

Explain why it is important for the acidity level of the blood to be kept stable within a specific range (homeostasis).

(5.75 points)

/continued on page 9/

23. א. Alcohol affects different systems in the human body.

(1) Drinking alcohol reduces the secretion of the hormone ADH . Use this fact to explain why it is dangerous for a person who is dehydrated to drink alcohol.

(2) Alcohol causes blood vessels in the skin to dilate (expand). Explain why this is dangerous in the case of a person who drinks alcohol and remains in a cold environment for a long time.

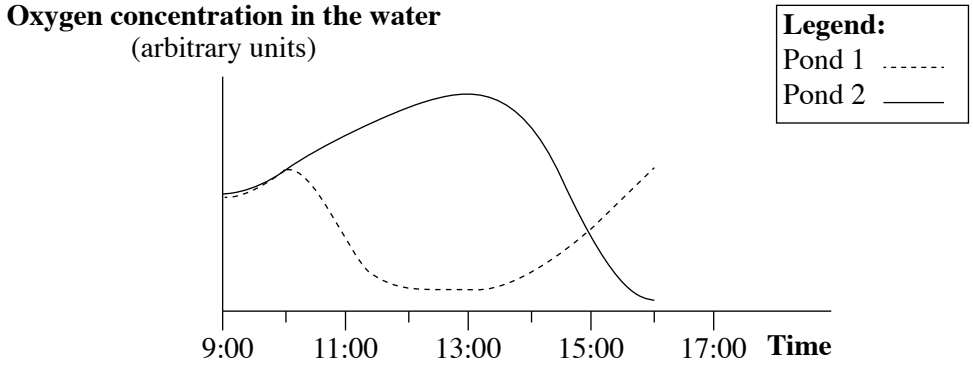
(5 points)

ב. List <u>two</u> physiological mechanisms in the human body which help maintain a constant body temperature (within a certain range) in a <u>cold</u> environment. (3.75 points)

24. Researchers measured the concentration of oxygen in the water in two ponds, Pond 1 and Pond 2. Both ponds contained aquatic (water) plants and animals. At the beginning of the experiment the abiotic conditions in both ponds were the same.

Each ponds was covered with a canopy that shaded it at different times of the day: Pond 1 was covered from 10:00 to 13:00, and Pond 2 was covered from 13:00 to 16:00.

The following diagram describes the results of the experiment.



א. Read statements 1–4 about the experiment and the processes that occurred in the ponds. Some of the statements are incorrect.

Copy <u>two</u> <u>incorrect</u> statements to your **answer booklet**, and explain why they are incorrect.

1. From 14:00 to 15:00 the rate of cellular respiration of all the organisms in Pond 1 was higher than the rate of photosynthesis in this pond.
2. At 15:00, the concentration of oxygen in both ponds was the same.
3. The plants performed cellular respiration only when the ponds were covered.
4. The abiotic conditions in both ponds remained constant throughout the experiment.

(5.25 points)

ב. The ponds are inhabited by aquatic plants and by animals that feed on the plants; no food is added from external sources.

If Pond 2 were to remain shaded all the time, how would the biomass of <u>all the consumers</u> in the pond change after a few weeks? Explain.

(3.5 points)

/continued on page 10/

25. א. Use the following table to compare mitosis with the **first** division in meiosis: Copy the table to your answer booklet and fill in the missing information. (5.75 points)

	Mitosis	**Meiosis – first division**
Separation of homologous chromosomes (present/absent)		
Separation of chromatids (present/absent)		
In the daughter cells—number of chromosomes (haploid/diploid)		
In the daughter cells—two chromatids in each chromosome (yes/no)		

ב. Researchers wanted to test the process of DNA replication. To do this, they added DNA to a test tube that contained nucleotides whose nitrogen base thymine (T) was radioactively labeled (T*).

One double-stranded molecule of DNA whose thymine was not labeled went through two cycles of replication.

The DNA that was produced in this replication contained labeled thymine.

Determine whether all the double-stranded DNA molecules that were obtained after two cycles of replication contained labeled thymine.

Explain your answer. (3 points)

/continued on page 11/

26. א. Figure A below shows strips of a green onion leaf before they were soaked in a salt solution of a certain concentration.

Figure B below shows a strip of green onion leaf after it was soaked in the salt solution. The figure also shows how the distance between the strip ends was measured after soaking.

Strips of green onion leaf

Figure B
After soaking in salt solution

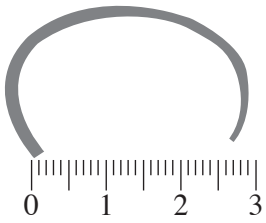
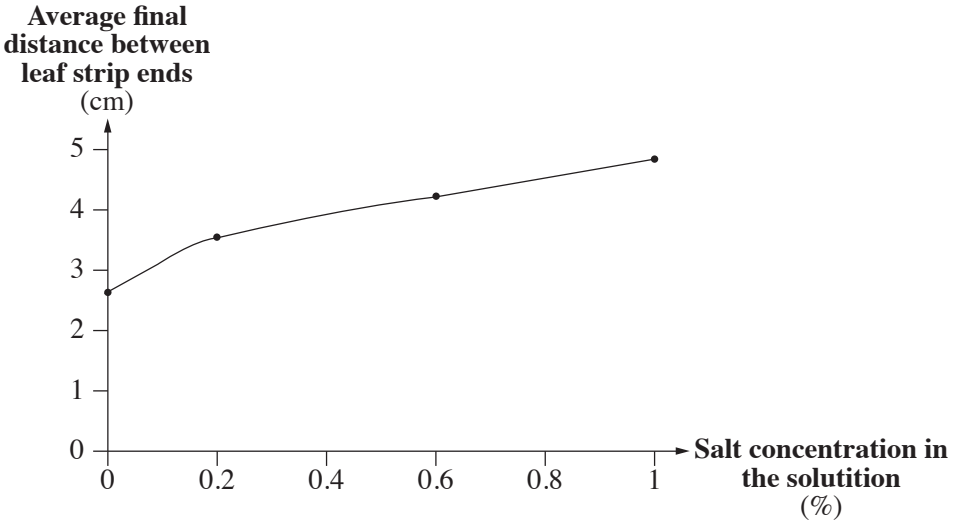


Figure A
Before soaking in salt solution

The following graph shows the results of an experiment in which the strips of green onion leaf were soaked for a few minutes in several salt solutions of different concentrations.
The initial distance between the ends of the leaf strips was 5 cm. Assume that the concentration of all the solutions in this experiment was lower than the concentration of solutes in the green onion cells.



Explain the results of the experiment. In your explanation, also discuss the difference in structure between different cells in the green onion leaf. (5 points)

ב. Pickleweed is a plant that grows in very salty soils. What property of pickleweed root cells might allow them to take up water from very salty soils? Explain.
(3.75 points)

/continued on page 12/

27. א. The table below shows RNA codons and the amino acids they encode.

Codons (RNA)	Amino Acid
UGG	Tryptophan
GCG GCU GCC GCA	Alanine
CAC CAU	Histidine
AAU AAC	Aspargine
AAA AAG	Lysine
AUG	Methionine

Shown below is a sequence of nucleotides in a segment of **DNA**. **Copy** it into your answer booklet.

Write the sequence of messenger RNA (mRNA) nucleotides that will be constructed based on this segment of DNA. Write the sequence from left to right.

Use the table above to translate the sequence of nucleotides you wrote down into a sequence of amino acids. Write from left to right. (5.75 points)

DNA: T T A C G G T T C

messenger RNA: _____

amino acids: _____

Copy to answer booklet

ב. Some amino acids are encoded by more than one codon.

Explain a possible benefit to an organism (living creature) of several different codons coding for the same amino acid in an environment with a high frequency of mutations.

(3 points)

/continued on page 13/

Part Three (18 points)

Part Three has three questions, 28–30.

Read the description of the research study below, and answer all of the questions 28–30. The number of points is given at the end of each item.

Not just going with the flow: Fertilization in the open sea

Oceans cover about 70% of Earth's surface. Processes that take place in the oceans, like reproduction, affect the entire planet. This is why these processes are widely studied.

28. Reproduction can be sexual or asexual.

What might be the benefit of sexual reproduction in an environment with changing conditions? Explain your answer. (4 points)

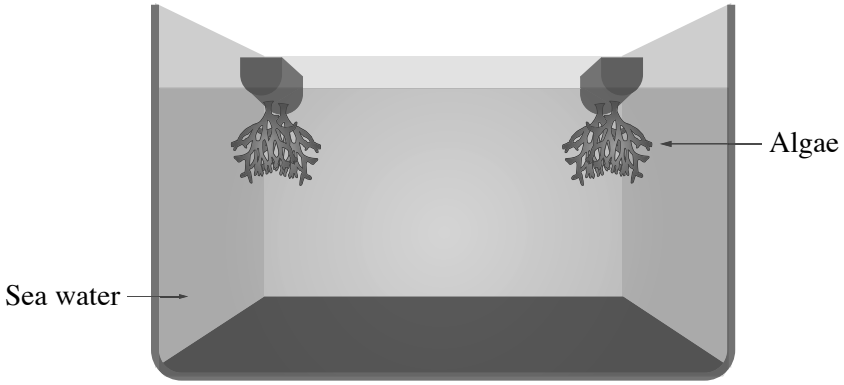
Algae are a group of organisms that perform photosynthesis and are common in oceans. *Gracilaria* (G) is a common genus of red algae (also common on the Israeli coast). In *Gracilaria*, some of the individuals are male and produce male gametes (reproduction cells) that are immobile and short-lived, and the other individuals are female and produce female gametes. After fertilization, the embryos develop in the female individuals.

For many years, scientists assumed that the male gametes of aquatic algae only reach the female gametes by traveling with water currents.

Researchers from Sorbonne University in France tested the hypothesis that algae gametes are transported in water also by animals.

The researchers noticed small crustaceans crowding around G algae. These crustacean belong to the genus *Idotea* (Id). The researchers decided to examine the connection between the crustaceans and algae reproduction.

They conducted several experiments in which they grew the algae in tanks of sea water (see figure).

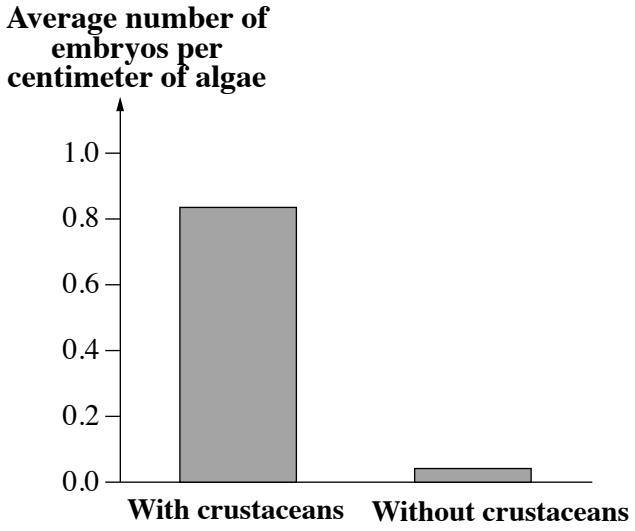


/continued on page 14/

Experiment 1

The researchers grew male G algae and female G algae in separate tanks. Next, they transferred the male algae and the female algae from the separate tanks into shared tanks, always keeping the same fixed distance between male and female algae. Then the researchers added 20 Id crustaceans to half of the tanks (20 in each tank). Some time later, they tested the rate of fertilization by counting the number of embryos that had developed in the female algae. The results are shown in Diagram 1.

Diagram 1: Algae fertilization rate with crustaceans and without crustaceans



In the second experiment, the researchers wanted to test whether the male gametes are transported on the crustaceans' bodies rather than carried by the water currents that the crustaceans create.

Experiment 2

The researchers cultured male algae with crustaceans and without female algae.

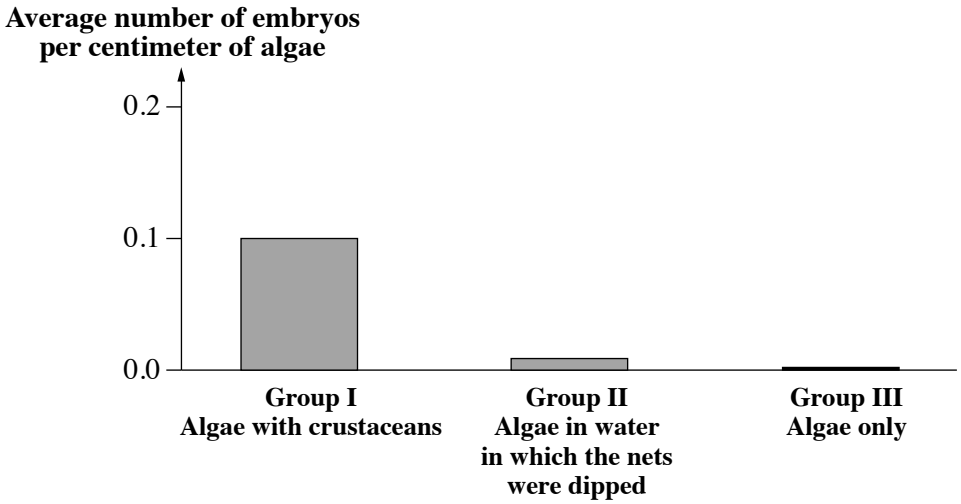
They also cultured female algae in three groups of tanks—I , II , III .

- They moved the crustaceans that had been together with male algae into the Group I tanks using nets.
- They dipped the nets—the ones they had used to move the crustaceans into the Group I tanks—in the Group II tanks.
- Nothing was added to the Group III tanks.

/continued on page 15/

The researchers tested the rate of algae fertilization in the three groups. The results are shown in Diagram 2.

Diagram 2: Algae fertilization rate in the three groups of tanks



Later in the study the researchers used a microscope to examine the crustaceans that had been with the male algae. They noticed male algae gametes on the bodies of the crustaceans.

29. Copy the following table to your answer booklet.

Consider each of the statements א–ד; for each statement in the table determine whether the results of the study support the statement, contradict it, or are insufficient to determine whether it is correct.

Write your answers in the table in your **answer booklet**.

Explain each of your answers. Base them on the study findings described in the passage.

(9 points)

Statement	**Study findings** (support statement/contradict statement/indeterminate)	**Explanation**
א. The presence of Id crustaceans in the habitat increases the chances of fertilization of G algae.		
ב. All the male gametes that participated in fertilization were transported by the crustaceans.		
ג. Male gametes of G algae are transported on the body of Id crustaceans.		
ד. Extinction of Id crustaceans in a marine habitat will cause the extinction of G algae in that habitat.		

/continued on page 16/

People today are increasingly aware of the possible implications of the climate crisis. Preserving populations of animals that contribute to the reproductive success of certain species of algae could affect climate changes.

30. Explain a possible connection between reproductive success of algae and a reduction in global warming. (5 points)

/continued on page 17/

Part Four (15 points)

Part Four includes three topics:

Topic I – Regulation of Gene Expression and Genetic Engineering – pages 18–19

Topic II – Developmental Comparative Physiology – pages 20–21

Topic III – Bacteria and Viruses in the Human Body – pages 22–23

Choose one topic and answer **two** questions on that topic, according to the directions given for the topic you chose.

(Note: The exam continues on the next page.)

/continued on page 18/

Topic I – Regulation of Gene Expression and Genetic Engineering

Answer two questions: Question 31 (required) and one of the questions 32–33. The number of points is given at the end of each item.

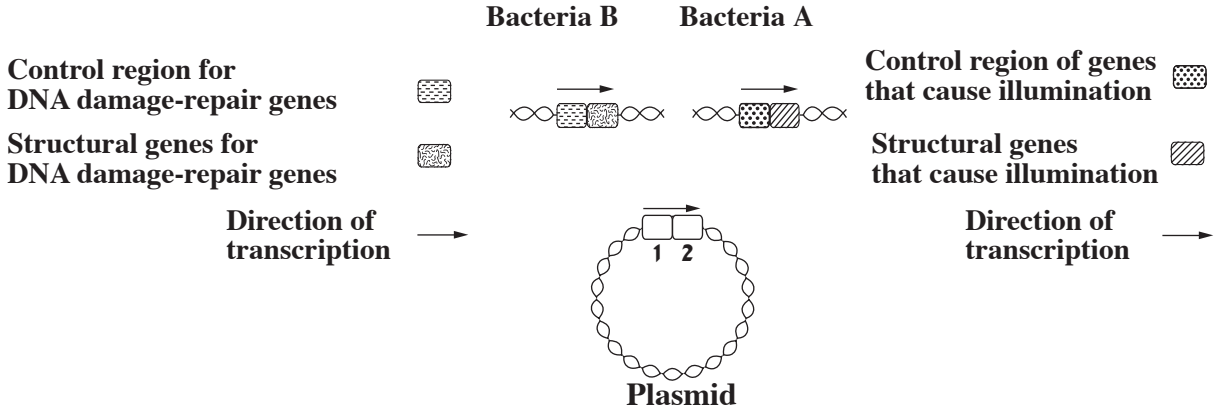
Answer Question 31 **(required)**.

31. Researchers used genetic engineering to create a bacterium that lights up when there is a substance in its vicinity that damages DNA.

The researchers had two types of bacteria: Type A—light-emitting bacteria, and Type B—bacteria that synthesize enzymes that repair damaged DNA.

They genetically engineered a plasmid from DNA segments taken from the two bacteria. The plasmid was then inserted into Type C bacteria.

The following figure describes the DNA segments from the first two types of bacteria and the genetically-engineered plasmid.



א. The genetically-engineered plasmid contains two components, **1** and **2**.

Of the four DNA segments shown in the figure, determine which DNA segment is component **1** of the plasmid and which is component **2** of the plasmid. (2 points)

ב. The researchers added Type A bacteria and Type C bacteria to water samples from two sources: water contaminated with DNA-damaging substances and clean water.

The following table shows the response of each of the types of bacteria to the two water samples.

Response of Type A and Type C bacteria to contaminated water or clean water

	Type C bacteria with plasmid	**Type A bacteria**
Contaminated water	illumination	illumination
Clean water	no illumination	illumination

Explain the results shown in the table for each type of bacteria. In your answer, discuss the two plasmid components that you determined in Item א. (3.5 points)

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

/continued on page 19/

ג. **(1)** The genetically-engineered plasmid contains a reporter gene [גן מדווח]. Determine which one of the two plasmid components you determined in Item א is the reporter gene.

(2) Genetically-engineered plasmids sometimes contain a selection gene [גן מסמיין].
Give one example of a selection gene, and **explain** how this gene permits proliferation of only the bacteria that contain these plasmids.

(3.5 points)

Answer one of the questions 32–33.

32. The tryptophan operon in *E. Coli* bacteria regulates the synthesis of enzymes that the bacteria need to produce the amino acid tryptophan.
This operon has a constantly-active control gene that encodes a repressor protein. The repressor attaches to the operator site only when tryptophan is present in the bacterial cell.

א. Will the enzymes necessary for production of tryptophan be produced when there is no tryptophan in the bacterial cell? Explain. In your explanation, discuss the control mechanism of gene expression. (3 points)

ב. Does tryptophan serve as the inducer in the tryptophan operon in the same way that lactose serves as the inducer in the lactose operon? Explain your answer. (3 points)

33. **א.** Some of the genes on the human X-chromosome are housekeeping genes.
Explain what a housekeeping gene is. (2 points)

ב. A certain muscular dystrophy (muscle degeneration) disease is caused by a recessive allele on the X chromosome.

(1) A father with muscular dystrophy and a mother who is heterozygous for the gene that causes this disease have a son. What is the chance that this son is healthy?
Explain your answer (you may use a diagram).

(2) In muscle samples taken from different organs of women who are heterozygous for this allele, researchers found many regions with damaged cells, as well as regions with healthy cells. Suggest an explanation for this finding.

(4 points)

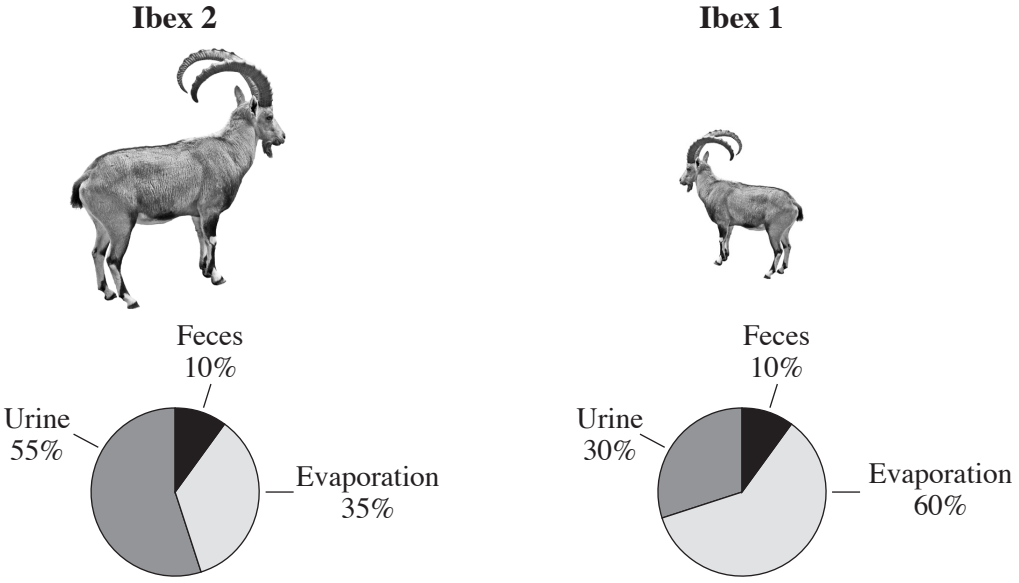
/continued on page 20/

Topic II — Developmental Comparative Physiology

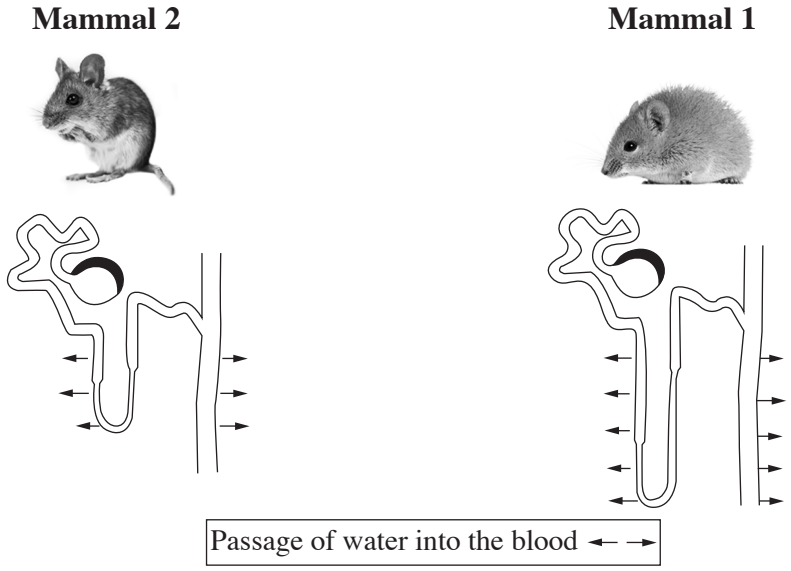
Answer two questions: Question 34 (required) and one of the questions 35–36. The point value is given at the end of each item.

Answer Question 34 **(required)**.

34. א. Mammals lose water from their body in different ways. Two male Nubian ibexes [יעל נובי] (mammals) with different-sized bodies were tested. Both ibexes live in Ein Gedi.
The following figure shows the two ibexes and the relative quantity of water that each lost while at rest, over a single 24-hour period. Suggest an explanation for the difference in the relative amount of water lost by **evaporation** between the two ibexes. In your explanation, discuss the size difference between the two ibexes. (3 points)



ב. The figure below shows two mammals of the same weight, each from a different habitat. Beneath each mammal is an enlarged representation of a nephron from that mammal's kidney.



Based on the nephrons, **determine** which mammal, 1 or 2, is adapted to a desert habitat, and **explain** your answer. (3 points)

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

/continued on page 21/

ג. **(1)** Name the type of nitrogenous waste that birds produce and the type of nitrogenous waste that mammals produce.

(2) In which of the two—birds or mammals—is the type of nitrogenous waste an advantage in a desert habitat? Explain your answer.

(3 points)

Answer one of the questions 35–36.

35. א. The table below shows some properties of the circulatory system in fish and birds. Copy the table to your **answer booklet** and fill in the missing information. (4 points)

	Fish	**Birds**
Number of chambers in the heart		
Is oxygen concentration the same in all the heart chambers? (yes/no)		
Type of circulatory system (single/double)		

ב. Organisms with a single circulatory system are unable to maintain a constant body temperature. Explain why. (2 points)

36. א. As they evolved, birds developed different adaptations for flight. Some of these adaptations occurred in their reproductive system.

Name one feature of the structure of birds' **reproductive system**, either in females or in males, that makes it easier for them to fly. **Explain** the advantage that this feature provides. (3 points)

ב. Fish embryos develop in eggs.

There is a difference in eggshell thickness between species of live-bearing fish and species of fish that lay eggs.

In which of these species would you expect to find a thicker eggshell? Explain. (3 points)

/continued on page 22/

Topic III – Bacteria and Viruses in the Human Body

Answer two questions: Question 37 (required) and one of the questions 38–39. The point value is given at the end of each item.

Answer Question 37 **(required)**.

37. א. Herpes and AIDS are diseases caused by viruses.
List two differences in the **viral components** between the herpes virus and the AIDS virus (HIV-1). (2.5 points)

ב. Substance X is an inhibitor of an enzyme that takes part in the transcription process in cells.
A person was infected with a DNA virus and the virus penetrated their skin cells.
Researchers are investigating whether Substance X can be an effective treatment for this virus if made into a cream and applied to sores that the virus caused on the skin.

(1) Does Substance X affect the replication of this DNA virus's genetic material in the infected cell? Explain.

(2) Does Substance X affect production of this DNA virus's capsid in the infected cell? Explain.

(4 points)

ג. AIDS is not a hereditary disease, but even so, babies born to women who have AIDS can be born sick. Explain both parts of this statement. (2.5 points)

/continued on page 23/

Answer one of the questions 38–39.

38. Bacteria are found in all body systems that are exposed to the outside environment.

א. Certain soaps have the following two properties: They contain a substance that dissolves fats, and their pH is very different from the pH of the skin.

Explain how each of these two properties can affect bacteria that live on skin.

(3 points)

ב. Skin injuries usually result in bacteria entering the body. Sometimes these bacteria cause disease and sometimes they do not.

Explain two factors that may determine whether the entry of bacteria will cause disease: one factor related to bacteria and one factor related to the human body. (3 points)

39. א. In certain cases, when bacteria are exposed to extreme environmental conditions, their reproduction rate decreases.

Explain why the antibiotic penicillin has a smaller effect on bacteria in extreme environmental conditions than on bacteria in normal environmental conditions. (3 points)

ב. Explain why the antibiotic erythromycin harms bacteria, but does not inhibit production of viruses **by human cells** that are infected with viruses. Discuss the mechanism of action of erythromycin in your answer. (3 points)

Good Luck!

בהצלחה!