

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

הוראות

א. Duration of the exam: Three hours

א. משך הבחינה: שלוש שעות.

ב. Exam structure and breakdown of points:

ב. מבנה השאלון ומפתח ההערכה:

This exam has four parts.
Part One – 32 points
Part Two – 35 points
Part Three – 18 points
Part Four – 15 points
Total – 100 points

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. Material that may be used during the exam:

A Hebrew–foreign language / foreign language–
Hebrew dictionary

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

ד. Special instructions:

Mark your answers to Part One on the answer sheet
at the end of your answer booklet.
Write your answers to Part Two, Part Three, and
Part Four in your answer booklet.

ד. הוראות מיוחדות:

את התשובות על השאלות בפרק הראשון יש לסמן
בתשובון שבסוף מחברת הבחינה.
את התשובות על השאלות בפרק השני, בפרק השלישי
ובפרק הרביעי יש לכתוב במחברת הבחינה.

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.

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

Good Luck!

בהצלחה!

Questions

Part One (32 points)

Part One has 20 questions, 1–20.

Answer all of the questions. If you answer at least 17 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 your answer booklet.
- * 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, 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: ■ .
- * **Do 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 this booklet and only later enter them into the answer sheet at the end of the answer booklet.

Answer all of the questions 1–20.

1. Which level of an ecological pyramid contains the smallest amount of energy?
 - א. top predators
 - ב. primary consumers
 - ג. producers
 - ד. secondary consumers

2. In which of the following processes are platelets involved?
 - א. ingestion of viruses that have entered the bloodstream
 - ב. regulation of the level of antibodies in the bloodstream
 - ג. transport of oxygen to the site of an infection
 - ד. maintaining blood volume after an injury

3. Immune memory makes it possible to:
 - א. distinguish between bacteria and body cells
 - ב. act quickly against a pathogen that has entered the body a second time
 - ג. prevent a foreign body from penetrating the body
 - ד. act immediately on first exposure to an antigen

4. The table below describes some components of these biological structures: a eukaryotic cell, a prokaryotic cell, and a virus.

Component Structure	Genetic material	Cell membrane	Cytoplasm	Mitochondria
1	+	–	–	–
2	+	+	+	+
3	+	+	+	–

According to this table, which of the combinations א–ד is correct?

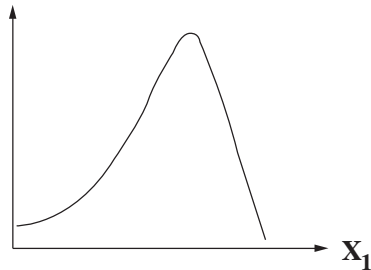
- א. 1 – prokaryotic cell; 2 – eukaryotic cell; 3 – virus
- ב. 1 – eukaryotic cell; 2 – prokaryotic cell; 3 – virus
- ג. 1 – virus; 2 – eukaryotic cell; 3 – prokaryotic cell
- ד. 1 – virus; 2 – prokaryotic cell; 3 – eukaryotic cell

5. How does planting trees help to reduce the greenhouse effect?
- א. Trees give shade, so it is less hot.
 - ב. Trees emit oxygen during photosynthesis.
 - ג. Growing trees in greenhouses traps the heat in the greenhouses.
 - ד. Trees absorb carbon dioxide during photosynthesis.
6. In which of the options א–ד below are the terms arranged in increasing order of size?
- א. hemoglobin, ribosome, red blood cell, capillary
 - ב. red blood cell, ribosome, capillary, hemoglobin
 - ג. ribosome, red blood cell, hemoglobin, capillary
 - ד. hemoglobin, ribosome, capillary, red blood cell
7. Which of the changes א–ד below could result in an increased rate of active export of sodium from the cell?
- א. The amount of CO_2 inside the cell is reduced.
 - ב. The ambient temperature increases from 40°C to 70°C .
 - ג. The amount of oxygen inside the cell increases.
 - ד. The amount of glucose inside the cell is reduced.
8. Myna birds are an example of an invasive species in Israel.
Which of the factors א–ד below makes it possible for a species to become invasive?
- א. The species has few predators in its new habitat.
 - ב. The species is less fit than other species.
 - ג. The species depends on one other species as its only food source.
 - ד. The species is able to cause damage to humans.
9. Which of the homeostatic processes א–ד below takes place in the kidneys?
- א. regulation of protein concentration in the blood
 - ב. regulation of salt concentration in the blood
 - ג. regulation of the amount of white blood cells
 - ד. regulation of sugar concentration in the blood

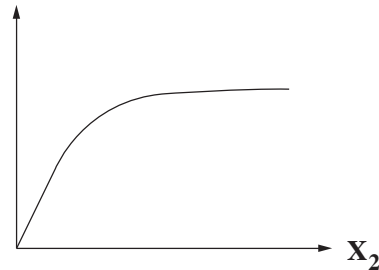
10. Consider the following two graphs. Each graph describes the effect of a different factor on the activity rate of a certain enzyme.

Which statement regarding X_1 and X_2 is correct?

Rate of enzyme activity



Rate of enzyme activity



- א. X_1 is temperature and X_2 is pH.
 - ב. X_1 is temperature and X_2 is substrate concentration.
 - ג. X_1 is enzyme concentration and X_2 is substrate concentration.
 - ד. X_1 is enzyme concentration and X_2 is pH.
11. Turtles are poikilothermic animals. After being in the sun for several hours, these turtles were able to move faster. What made this possible?



Photo: Gertie Mor, ORT Kiryat Motzkin

- א. The rate of breakdown of organic materials in their cells was reduced.
 - ב. Their body temperature remained constant.
 - ג. The metabolic rate in their cells increased.
 - ד. Their respiration rate was reduced.
12. When fasting, blood glucose concentration remains fairly constant. What makes this possible?
- א. When fasting, body cells do not perform cellular respiration, and, therefore, they do not consume glucose.
 - ב. When fasting, the level of the hormone insulin goes up, and, therefore, the body cells do not take up glucose from the blood.
 - ג. When fasting, the re-absorption of glucose from the blood into the nephrons increases.
 - ד. When fasting, the level of the hormone glucagon in the blood increases, which increases the rate at which glycogen stores are broken down.

13. Cells in the human body usually carry two copies of each chromosome.

In Down syndrome, cells carry three copies of a certain chromosome (Chromosome 21). What might cause this?

- א. failure of two chromosomes to separate during meiosis
- ב. an egg cell that is fertilized by two sperm cells
- ג. an error in DNA replication
- ד. independent separation of chromosomes during mitosis

14. Why does adrenaline only affect some of the cells in the body?

- א. Because adrenaline reaches only some of the cells, and only affects the ones it reaches.
- ב. Because each cell has only one type of receptor.
- ג. Because only cells with specific receptors for adrenalin are affected by it.
- ד. Because hormones can only affect organs that are distant from the site where they are secreted.

15. Energy storage molecules [חומרי תשמורת] are not water soluble.

This property benefits organisms who store these molecules in their cells, because:

- א. energy storage molecules can be stored without affecting the concentration of solutes in the cell.
- ב. energy storage molecules can be transported quickly from their storage site to the location where they are consumed.
- ג. energy storage molecules can be broken down quickly.
- ד. energy storage molecules can be dispersed evenly throughout the cell.

16. In a certain habitat there was a sharp decline in the number of plants. What is the expected outcome?

- א. An increase in the habitat's carrying capacity
- ב. A decline in the biomass of primary consumers
- ג. A decline in the concentration of CO_2 in the air
- ד. An increase in the amount of pollinators

17. Which statement below about the nervous system is correct?

- א. An electrical signal travels along a neuron and triggers release of a neurotransmitter at the synapse.
- ב. A neurotransmitter travels along a neuron and is transported directly to the next neuron.
- ג. An electrical signal is the only way in which information travels through the nervous system.
- ד. A neurotransmitter is secreted by a neuron and this causes an electrical signal to pass at the synapse.

18. What determines the order of amino acids in a protein molecule produced in a cell?
- The amount of messenger RNA (mRNA) in the cell
 - The number of transfer RNA (tRNA) molecules in the cell
 - The types of amino acids in the cell
 - The sequence of bases in the cell's DNA
19. Which of the assumptions א–ד below is a fundamental assumption in the theory of evolution?
- All individuals in a population survive and have offspring.
 - Individuals in a population vary genetically from one another.
 - Acquired traits are passed to the next generation.
 - There are fewer offspring than adult individuals.
20. What can cause peripheral blood vessels in the skin to dilate?
- Considerable loss of water from the body
 - A shift from exertion to rest
 - An increase in body temperature
 - Reduced blood pressure

Note: Mark your answers on the answer sheet at the end of the answer booklet.
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Part Two (35 points)

Part Two has seven questions, 21–27.

Choose four questions and answer them in your **answer booklet** (each question – 8.75 points).

21. Researchers cultivated corn plants in three containers:

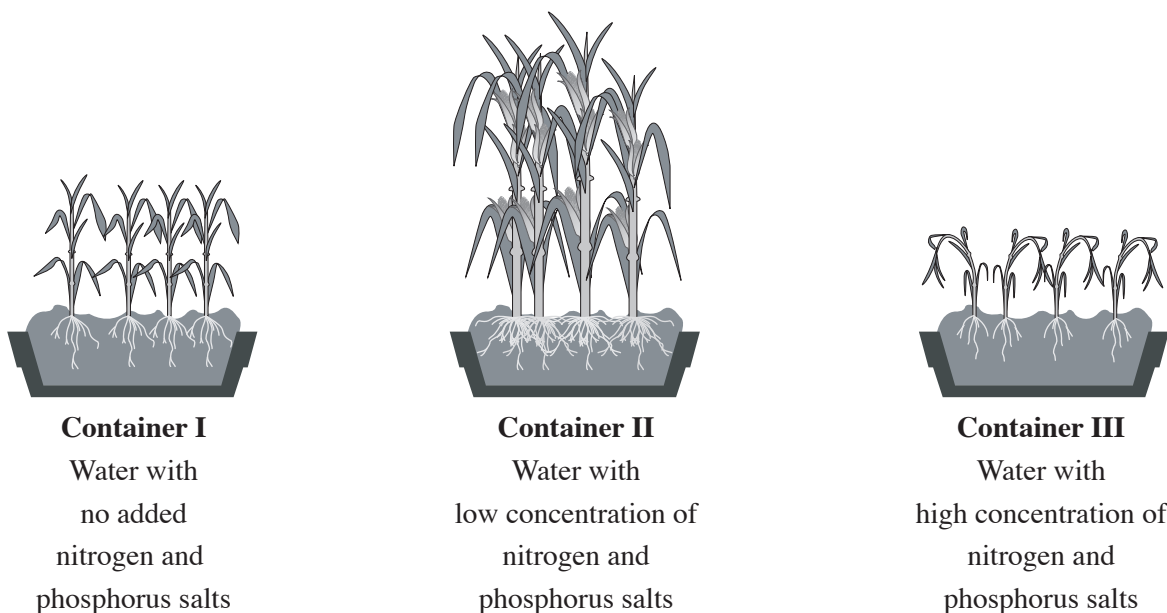
Container I – plants irrigated with water with no added nitrogen and phosphorus salts.

Container II – plants irrigated with water with added nitrogen and phosphorus salts at a low concentration.

Container III – plants irrigated with water with added nitrogen and phosphorus salts at a high concentration.

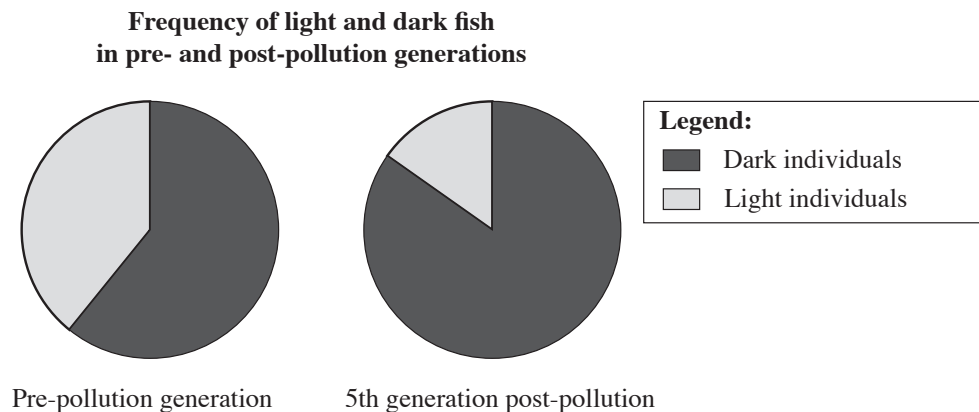
All other growing conditions were identical.

The results are described in the illustrations below.

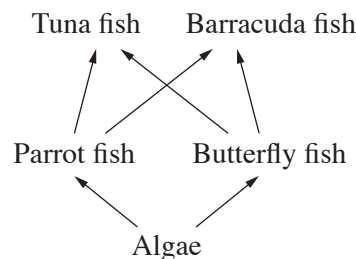


- א. Explain the difference in results between Container I and Container II. In your answer, discuss one organic substance in the cells that contains either nitrogen (N) or phosphorus (P) or both. (5 points)
- ב. Explain the difference in results between Container II and Container III. (3.75 points)

22. A fish population inhabiting a lake bed has individuals of two colors, light and dark. Following a pollution incident, the color of the lake bed became darker. Researchers checked the frequency of individuals of both colors in the population over several generations. The diagram below shows the frequency of individuals of both colors before the lake became polluted, and in the fifth generation after the lake became polluted.



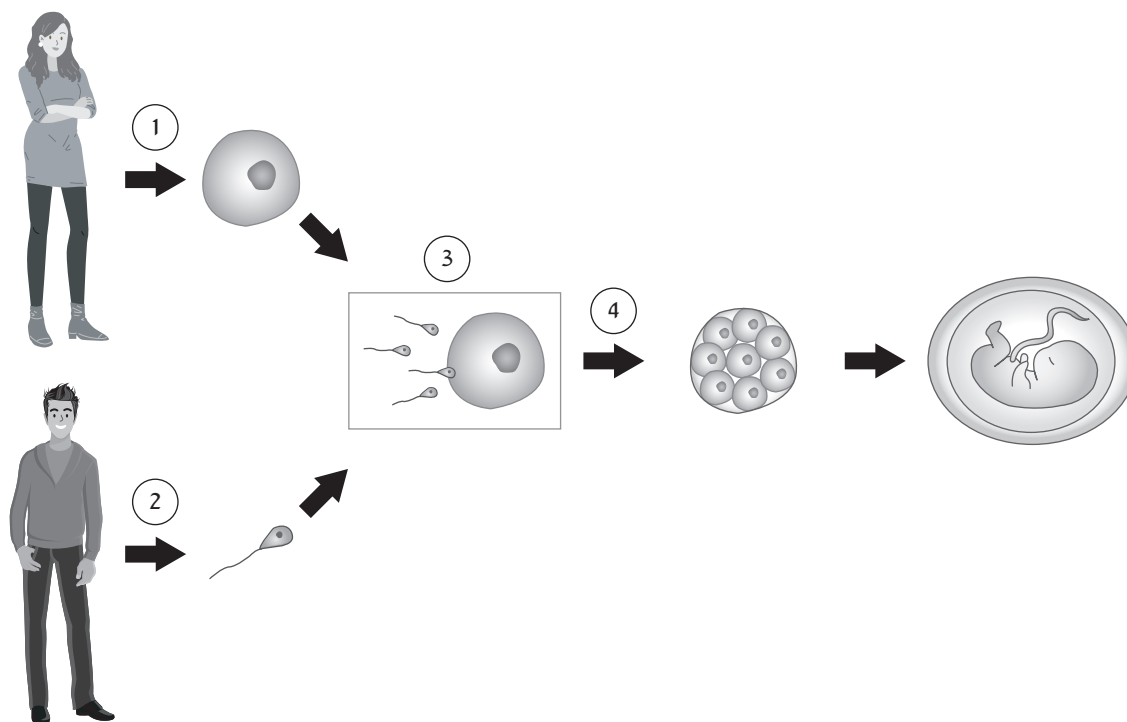
- א. Based on the graph, **specify** what the difference is in color frequency between the two generations shown, and **suggest one** possible explanation for this difference. (4.75 points)
- ב. The diagram below describes part of a food web [מארג מזון] in a marine habitat.



Several types of relationships exist in this food web. **List two** types of relationships that exist in this food web.

For each type of relationship you listed, **provide** an example from this food web of organisms that have this relationship. (4 points)

23. א. The illustration below describes stages in human reproduction.



For each of the stages 1–4, determine which process takes place at that stage: meiosis, or mitosis, or neither of the two (you do not need to explain your answer). (3.75 points)

- ב. Albinism [לבקנות] in humans is caused by the body not producing the pigment melanin. This trait is determined by a certain gene with two alleles, which affect melanin production:

The dominant allele A – melanin is produced.

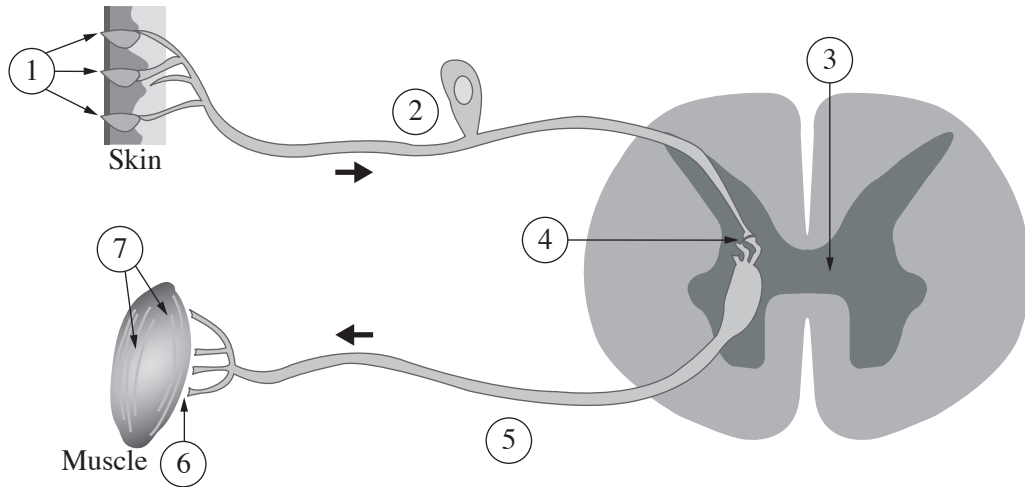
The recessive allele a – melanin is not produced.

A couple, a man and a woman, are not albino but each have one parent with albinism. The couple has several children.

Provide the genotypes of the couple and the genotypes and phenotypes of all possible offspring they might have. (5 points)

24. A person touched a very hot pan and his hand recoiled reflexively.

א. The figure below describes what happens in a reflex.



Copy the following table to your answer booklet and **match** each number in the figure with one term from the list of terms below.

Note: One term may match more than one number.

List of terms: motor neuron, sensory neuron, synapse, spinal cord, target cells, sensory cells.

(6 points)

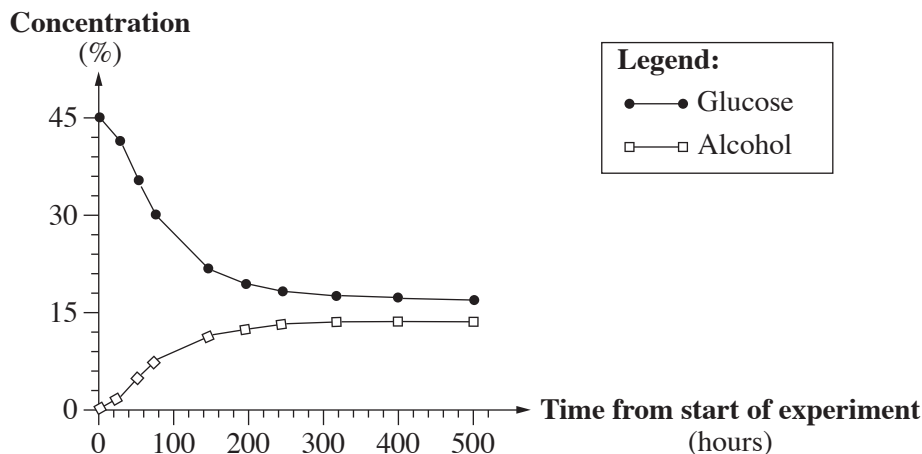
Number in figure	Term
1	
2	
3	
4	
5	
6	
7	

ב. Explain what makes a reflex response faster than a voluntary response.

(2.75 points)

25. א. Researchers cultured yeast in a flask containing a solution with glucose. There was no oxygen in the flask. They measured the concentration of glucose and the concentration of alcohol in the flask over a period of 500 hours. The results are shown in the graph below.

Concentration of glucose and alcohol during the experiment



We know that a high concentration of alcohol damages yeast cells.

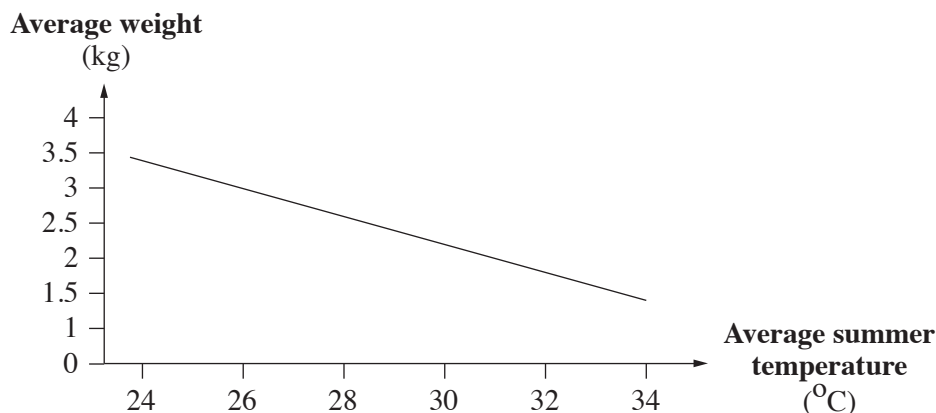
Describe and **explain** the results obtained at 0–200 hours and at 400–500 hours. In your explanation, discuss both glucose concentration and alcohol concentration. (5.75 points)

- א. A laboratory tested the effect of adding a detergent to yeast cells, and the effect of heating yeast cells to 70°C.

Explain the difference between the effect of the detergent and the effect of heating to 70°C on the membranes of yeast cells. (3 points)

26. א. Researchers tested the association between rabbit size and summer temperatures in their habitats. We know that the larger a rabbit is, the more it weighs. The researchers weighed rabbits from areas in Israel with different environmental temperatures. Their findings are shown in the graph below.

Average rabbit weight in different regions

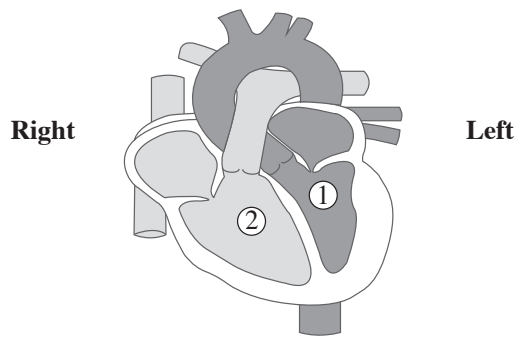


Based on the graph, **describe** the association between average rabbit weight and environmental temperature.

Based on the information given at the beginning of this question, **explain** how the association you described reflects an adaptation to a warm environment. (5 points)

- א. **Name** and **explain** one adaptation to a desert habitat that occurs in plants. (3.75 points)

27. א. The figure below describes a heart with two of its parts labeled 1 and 2.



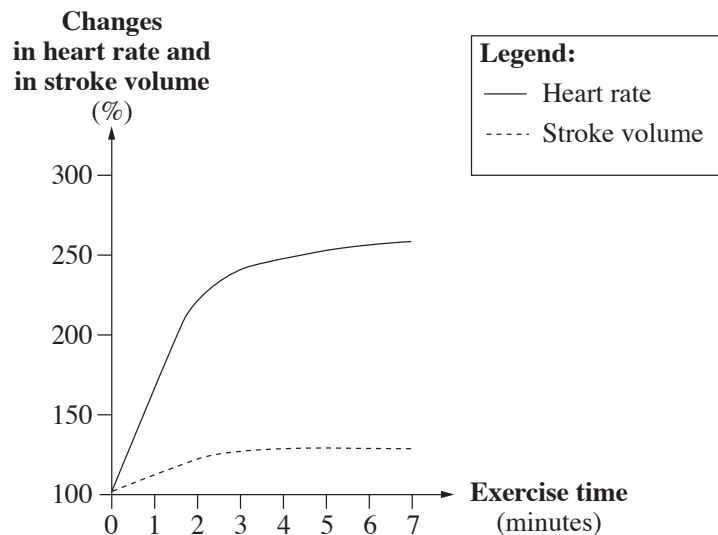
Consider the two statements below:

- I The route traveled by blood leaving Part 1 and returning to Part 1 is equal in length to the route traveled by blood leaving Part 2 and returning to Part 2.
- II There is a structural difference between Part 1 and Part 2, which is why the blood pressure at the exit from Part 1 is different from the blood pressure at the exit from Part 2.

Name Part 1 and Part 2, and **explain** each of the two statements. (5 points)

- א. The graph below describes changes in heart rate and in stroke volume of a certain person during 7 minutes of exercise. 100% represents this person's measurements at rest.

Changes in heart rate and stroke volume at rest and while exercising



Explain how each of the changes in the first two minutes of activity make it possible to perform strenuous physical activity. (3.75 points)

Part Three (18 points)

Part Three has three questions, 28–30.

Read the passage below, and answer all of the questions 28–30 in your answer booklet.

Don't Bury Your Head in the Sand – How Light Pollution Affects Sandy Beaches

Many of the world's beaches are sandy habitats, and many of the species inhabiting them are nocturnal (active at night). These organisms are increasingly exposed to artificial light at night due to human activity on or near sandy beaches.

Artificial light that changes the natural cycle of light and dark in a natural habitat is called **light pollution**. Light pollution in the world is growing every year.

Many studies show that on beaches with light pollution, certain species of nocturnal animals are noticeably less active than the same animals on beaches with no light pollution.

The following two studies examined the effect of light pollution.

Study I

Researchers investigated the effect of light pollution on a species of crab that inhabits sandy beaches. This species of crab is nocturnal. These crabs burrow into the sand, staying below the surface during the day, and are active at night—moving around on the surface and feeding on algae on the beach. The researchers measured the crabs' activity level in two zones on the beach: a zone with no light pollution and a zone with light pollution. The activity rate in the zone with no light pollution was defined as 100% activity rate.

The results are shown in the table below.

Crab activity rate in the two zones

Average rate of activity (%)	
No light pollution zone	Light pollution zone
100	30

Later in this study, the researchers collected crabs of this species at a sandy beach with no light pollution, brought them to the lab, and split them into two groups.

During the day, both groups were exposed to light conditions that were identical to those in their natural habitat.

During the night, one group was exposed to light pollution and the other group was not exposed to light pollution. All other conditions were identical for both groups.

The researchers measured crab food consumption and growth rate in both groups. The results are shown in Diagrams 1 and 2.

Diagram 1: **Crab food consumption in different light conditions**

Average food consumption
(grams per crab per 24h)

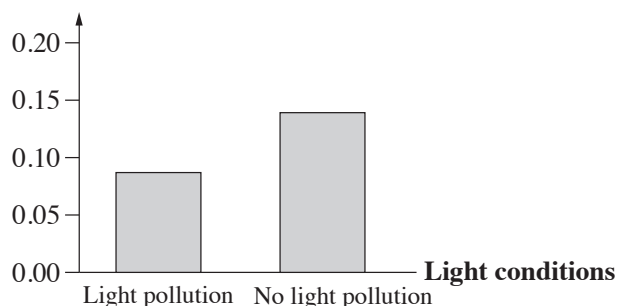
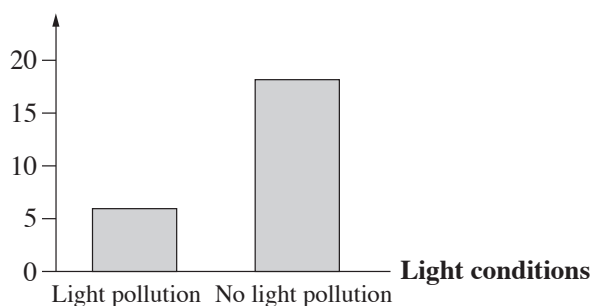


Diagram 2: **Crab growth rate in different light conditions**

Average growth rate
(mg per crab per 24h)



28. Based on the information in the passage and the data in the table and in Diagrams 1 and 2, explain what caused the difference in growth rate between the two groups. In your explanation, also discuss processes taking place in the cells. (5 points)

Study II

In this study, the researchers investigated the effect of light pollution on the amount of nucleic acids in the cells of a certain species of beetle. Like the crabs in Study I, these beetles are active at night and burrow into the sand and stay submerged during the day.

The researchers collected some beetles of this species on a sandy beach with no light pollution, brought them to the lab, and split them into two groups.

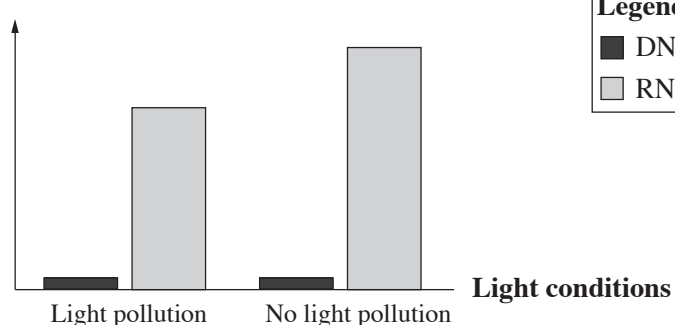
During the day, both groups were exposed to light conditions identical to the natural conditions in their habitat.

During the night, one group was exposed to light pollution and the other group was not exposed to light pollution. All other conditions were identical for both groups.

The researchers measured the amounts of DNA and RNA in the body cells of individuals from both groups. The results are shown in Diagram 3.

Diagram 3: **Amounts of DNA and RNA in beetles exposed to different light conditions**

Average amount
(arbitrary units)



29. א. Light pollution affects living organisms.

(1) Read the two statements below:

I Light pollution does not affect the genes themselves.

II Light pollution affects gene expression.

Determine which of the results found in Study II might support each statement.

(2) In Study II, the researchers also measured the amount of protein produced in the beetles' cells. They found that beetles in the group exposed to light pollution produced a different amount of protein than the beetles in the group not exposed to light pollution.

Discuss the results shown in Diagram 3 and **hypothesize** which group of beetles produced less protein. **Explain** your hypothesis.

(6 points)

ב. Assuming that light pollution had a similar effect on the crabs and beetles in these studies, explain how the findings shown in Diagram 3 can explain the findings shown in Diagram 2.

(4 points)

30. In Study I (the effect of light pollution on crabs) the researchers took measurements in the wild and in the laboratory.

List one advantage and one disadvantage of measurements made in the laboratory compared with measurements made in the wild. (3 points)

Part Four (15 points)

This part includes three topics:

Topic I: Regulation of Gene Expression and Genetic Engineering – pages 17–19

Topic II: Comparative Developmental Physiology: Unicellular Organisms to Mammals – pages 20–21

Topic III: Bacteria and Viruses in the Human Body – pages 22–24

Choose one topic, I, II, or III, and answer two questions according to the directions given under the topic you chose.

Topic I — Regulation of Gene Expression and Genetic Engineering

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

Answer Question 31 (**required**).

31. א. The cells of many organisms carry the gene H which encodes the protein HSP. This protein can prevent denaturation of proteins in the cell.

Researchers discovered different control processes in two cases related to production of the HSP protein:

- I When the temperature increases greatly: a control protein binds to a certain DNA site, and as a result the amount of HSP in the cell increases.
- II When the temperature goes down: a short RNA strand (microRNA) binds to the mRNA that encodes HSP, and as a result the amount of HSP in the cell does **not** increase.

The researchers were awarded a Nobel Prize for discovering these control processes.

(1) **Determine** the following: at what stage of the pathway from DNA to protein does control of HSP protein production occur in each of the cases, I and II? **Explain** your answer in each case.

(2) Explain why the function of a denatured protein might be damaged, even if the order of its amino acids has not changed.

(4.5 points)

- ב.** Cells have a great variety of proteins. There are many more types of proteins produced in a eukaryotic cell than there are structural genes in such a cell. **Name** the process that makes this possible, and briefly **explain** how this process results in the production of multiple proteins from a single gene. (3 points)

Answer one of the questions 32–33.

32. א. There is a great demand in the world for black leather products and clothing, but their manufacture causes serious environmental harm. Researchers have tried to find alternatives to these harmful manufacturing processes, for example by using genetically engineered bacteria as in the following study:

Type **A** bacteria naturally produce cellulose [תאית], which is a light brown.

Type **B** bacteria produce the substance melanin, which is black.

Researchers were able to genetically engineer type **A** bacteria that also produce melanin. These bacteria can then be used to manufacture sheets of black cellulose, which could serve as an alternative to fabric and leather.

- (1) The plasmid used to produce the genetically engineered bacteria contains several components. **Copy** from the list below to your answer booklet the essential components that must be present in this plasmid. **Explain** why each component is essential.

- a structural gene that encodes an enzyme that is essential in producing melanin
- a gene that encodes a DNA replicating enzyme
- a control site
- a structural gene that encodes an enzyme that is essential in producing cellulose

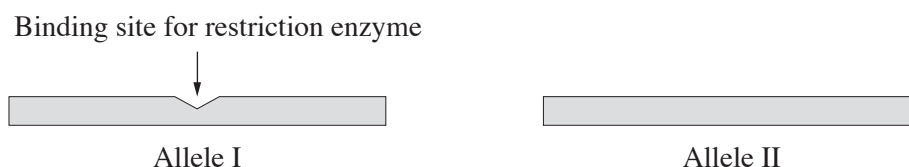
- (2) Another gene encoding resistance to an antibiotic was inserted into the plasmid. Explain how this gene functions as a selection gene [גן ממיין].

(5.5 points)

- ב. Scientists can create genetically engineered bacteria using animal genes, too. Explain why bacteria can produce proteins from a gene that originated in an animal cell. (2 points)

33. א. The gene for fur color in mice has two alleles: Allele I and Allele II. Allele I has a binding site for the restriction enzyme E. This enzyme cuts the allele into two equal parts. Allele II does not have a binding site for this restriction enzyme (Figure 1).

Figure 1



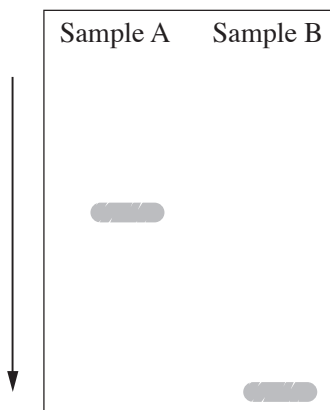
Researchers crossed a male mouse that is homozygous to Allele I with a female mouse that is homozygous to Allele II.

They took DNA samples from each parent and from their one offspring, and isolated the gene for fur color in each sample.

Next, they added the restriction enzyme E to the isolated genes, replicated them by PCR, and analyzed the resulting samples by gel electrophoresis.

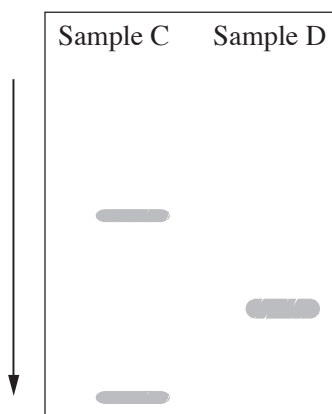
(1) The gel electrophoresis results from the parents' samples are shown in the diagram below.

Determine which sample, A or B, belongs to the male parent and which belongs to the female parent. **Explain** your answer for each sample.



(2) Consider the following gel electrophoresis of two samples.

Determine which of the two samples, C or D, was taken from the offspring. **Explain** your answer.



(5.5 points)

- א. The test that is used to genetically identify family members compares highly variable regions of DNA. These regions do not encode essential proteins.

Explain why regions that do encode essential proteins are not highly variable. (2 points)

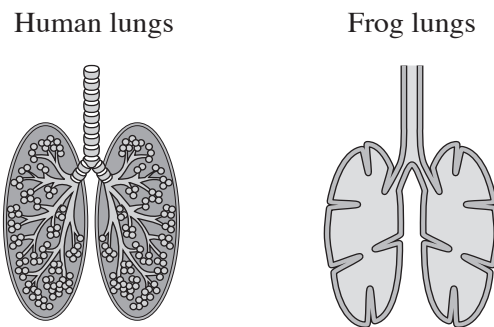
Topic II — Comparative Developmental Physiology: from Unicellular Organisms to Mammals

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**).

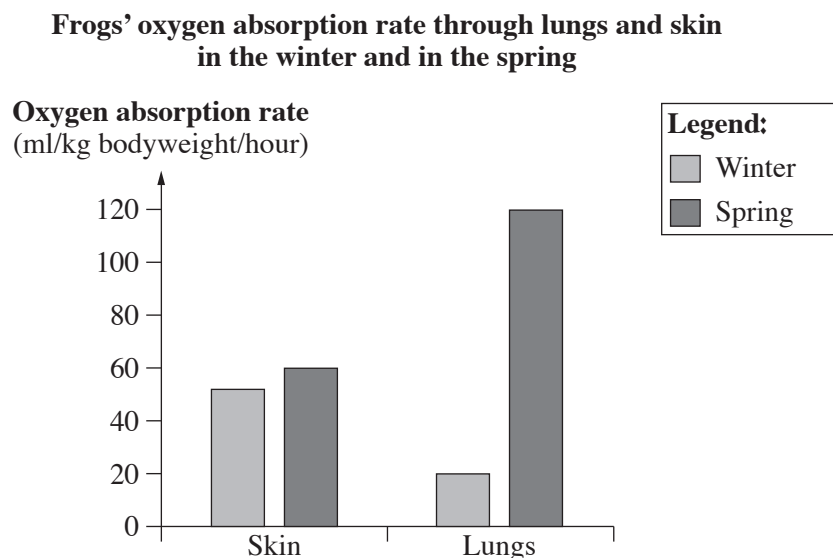
34. א. Consider the following illustrations of lungs of a frog and lungs of a human.

Determine in which of these two organisms gas exchange in the lungs is more efficient, and **explain** your answer. (2.5 points)



א. Frogs are poikilothermic organisms. In frogs, gas exchange occurs through both the lungs and the skin.

Researchers measured frogs' rate of oxygen absorption through the lungs and through the skin in different seasons. The results are shown in the diagram below.



(1) Explain why there is a difference between the two seasons in oxygen absorption rate through the **lungs**.

(2) Explain why there is almost no difference between the two seasons in the rate of oxygen absorption through the **skin**.

(5 points)

Answer one of the questions 35–36.

35. א. Fish and bird embryos develop inside eggs.

(1) The table below contains a list of characteristics.

Copy the table to **your answer booklet**, and fill in the correct option for fish and bird eggs: yes or no.

Life form Characteristic	Fish	Birds
A calcareous [with calcium] egg shell (yes / no)		
Gases pass through the egg's external surface (yes / no)		
An embryonic urine sac in the egg (yes / no)		
Amniotic fluid in the egg (yes / no)		

(2) As the bird embryo develops, the weight of its yoke sac decreases, while the embryo's weight increases.

Studies show that the embryo's weight increase is smaller than the yoke's weight loss.

Explain this finding.

(4.5 points)

א. Some fish species are viviparous (live-bearing) and other species are oviparous (lay eggs).

List one similarity and one difference between the reproduction processes of live-bearing fish and egg-laying fish. (3 points)

36. א. (1) The largest known insect in the world belongs to a group called weta, and it is 8 cm long. Mammals like elephants and whales, on the other hand, can grow to lengths of several meters.

Insects larger than a few centimeters in length cannot exist. Propose an explanation for this. In your answer, discuss the difference between an open circulatory system and a closed circulatory system.

(2) List two differences between mammals and insects in oxygen transport to the cells in their body.

(5 points)

א. In certain insects air flow in the respiratory system is **bidirectional** – air enters and exits through the same opening, while in other insects air flow in the respiratory system is **unidirectional** – air enters through one opening and exits through another opening. In a unidirectional system, oxygen supply to the cells is more efficient. Explain why. (2.5 points)

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. Tetanus, cholera, and herpes are diseases caused by different pathogens.

⌘. Each of the following three figures illustrates how one of these pathogens works.

Figure 1

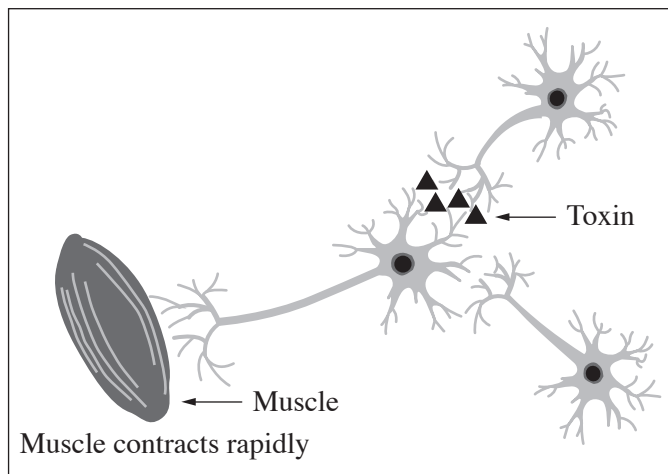


Figure 2

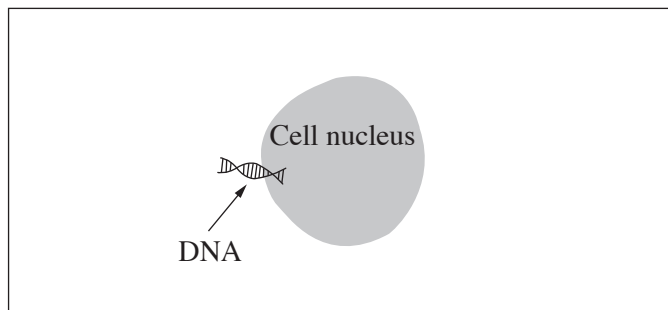
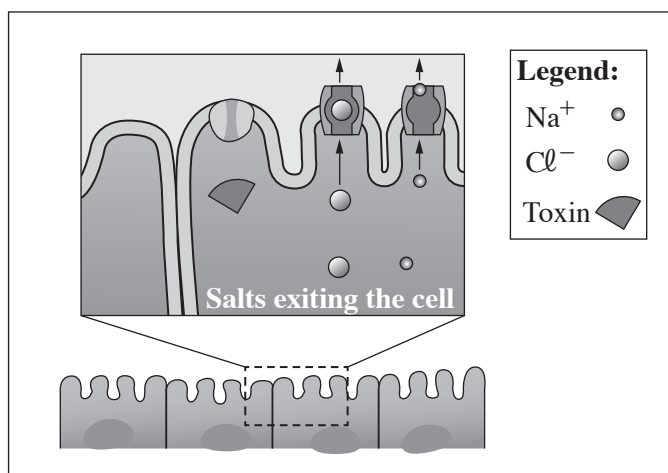


Figure 3



(Note: Item ⌘ of this question continues on the next page.)

/continued on page 23/

Copy the table to your answer booklet and **fill in** the missing information. (4 points)

Figure	Disease (tetanus / cholera / herpes)	Pathogen (bacteria / virus)	Why this figure is an illustration of this disease
Figure 1			
Figure 2			
Figure 3			

2. A person who was never immunized against tetanus was injured and became infected with the pathogen that causes tetanus.

(1) This person received an anti-tetanus immunization immediately after being injured.

Determine what type of immunization the injured person was given (active or passive), and **explain** your answer.

(2) If, instead of an immunization, this person had taken a medicine that targets the microorganisms that cause tetanus, he would still have had the symptoms of the disease. Explain why.

(3.5 points)

Answer one of the questions 38–39.

38. Type P bacteria are pathogens.

Type M bacteria attach to type P bacteria. They secrete enzymes into type P bacteria that accelerate the breakdown of substances, and then make use of the breakdown products.

א. Name the type of relationship between type M bacteria and type P bacteria. (2 points)

ב. (1) It was found that under aerobic conditions, type P bacteria proliferate at a lower rate in the presence of type M bacteria than in the absence of type M bacteria.

The greatest decrease in type P proliferation rate occurs when type P bacteria are in the exponential (logarithmic) phase of proliferation.

Explain why the greatest decrease occurs when type P bacteria are in the exponential phase.

(2) Type P bacteria can reproduce in aerobic and also in anaerobic conditions.

Type M bacteria were found to have no effect on the proliferation of type P bacteria under anaerobic conditions.

Based on this finding, **determine** whether **type M** bacteria produce energy using aerobic or anaerobic respiration.

Explain your answer.

(5.5 points)

39. AZT is a medication given to AIDS patients.

א. AZT is a substance that disrupts the activity of the enzyme reverse transcriptase. The substance slows down the progress of the disease, but does not destroy the genetic material of the HIV virus.

(1) Explain why AZT slows down the disease's progress.

(2) Explain why AZT does not destroy HIV viruses in the patient's bloodstream.

(4.5 points)

ב. AZT can damage mitochondria. Explain why this damage can make a person feel weak.

(3 points)

Good Luck!

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אין להעתיק או לפרסם אלא ברשות משרד החינוך