CENTRALNA KOMISJA EGZAMINACYJNA

Arkusz zawiera informacje prawnie chronione do momentu rozpoczęcia egzaminu.

WYPEŁNIA ZDAJĄCY

KOD

PESEL

Miejsce na naklejkę.
Sprawdź, czy kod na naklejce to **M-100**.
Jeżeli tak – przyklej naklejkę.
Jeżeli nie – zgłoś to nauczycielowi.

Egzamin maturalny ***Formuła 2023***

BIOLOGIA

Poziom rozszerzony

Dodatkowe zadania w języku angielskim

Symbol arkusza
MBIA-Z0-**100**-2305

DATA: **23 maja 2023 r.**

GODZINA ROZPOCZĘCIA: **15:20**

CZAS TRWANIA: **80 minut**

LICZBA PUNKTÓW DO UZYSKANIA: **25**

Przed rozpoczęciem pracy z arkuszem egzaminacyjnym

1. Sprawdź, czy nauczyciel przekazał Ci **właściwy arkusz egzaminacyjny**, tj. arkusz we **właściwej formule**, z **właściwego przedmiotu** na **właściwym poziomie**.
2. Jeżeli przekazano Ci **niewłaściwy** arkusz – natychmiast zgłoś to nauczycielowi. Nie rozrywaj banderol.
3. Jeżeli przekazano Ci **właściwy** arkusz – rozerwij banderole po otrzymaniu takiego polecenia od nauczyciela. Zapoznaj się z instrukcją na stronie 2.

Instrukcja dla zdającego

1. Sprawdź, czy arkusz egzaminacyjny zawiera 15 stron (zadania 1–10). Ewentualny brak zgłoś przewodniczącemu zespołu nadzorującego egzamin.
2. Na pierwszej stronie arkusza oraz na karcie odpowiedzi wpisz swój numer PESEL i przyklej naklejkę z kodem.
3. Odpowiedzi zapisz w miejscu na to przeznaczonym przy każdym zadaniu.
4. Pisz czytelnie. Używaj długopisu/pióra tylko z czarnym tuszem/atramentem.
5. Nie używaj korektora, a błędne zapisy wyraźnie przekreśl.
6. Pamiętaj, że zapisy w brudnopisie nie będą oceniane.
7. Możesz korzystać z *Wybranych wzorów i stałych fizykochemicznych na egzamin maturalny z biologii, chemii i fizyki*, linijki oraz kalkulatora prostego. Upewnij się, czy przekazano Ci broszurę z okładką taką jak widoczna poniżej.

Zadania egzaminacyjne są wydrukowane na następnych stronach.

Task 1.

Vaccines promote the development of population immunity and therefore are one of the most effective methods of fighting infectious diseases.

Task 1.1. (0–1)

Complete the sentence below. Choose and mark the correct answer A or B and the correct answer from numbers 1–3.

After reaching blood plasma, viral proteins contained in a vaccine will evoke an immune response

A.	of cellular type,	which involves	**1.**	cytotoxic T cells, which kill the infected cells.
			2.	B cells, which are responsible for the production of antibodies.
B.	of humoral type,		**3.**	granulocytes, which produce lysozyme.

Task 1.2. (0–1)

Describe the importance of post-vaccine immune memory during the secondary immune response.

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Task 1.3. (0–1)

The names of several diseases are listed below. Choose and mark the names of <u>viral</u> diseases.

A. tuberculosis **B.** AIDS **C.** influenza **D.** tetanus **E.** Lyme disease

Task 1.4. (0–2)

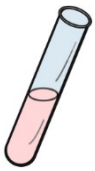
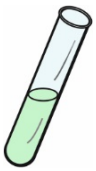
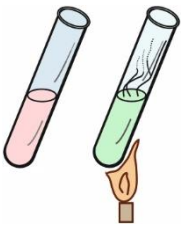
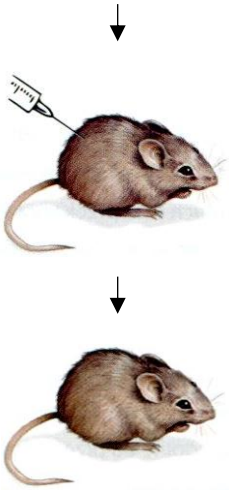
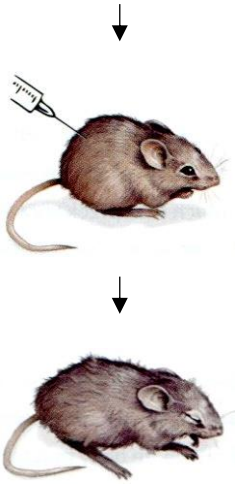
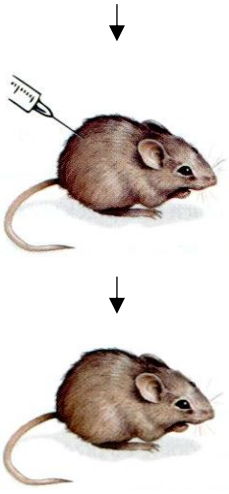
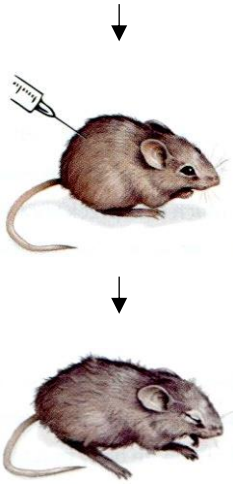
Mark <u>three</u> appropriate endings of the sentence.

Vaccine administration induces the production of antibodies and gaining immunity that is

A. natural.
B. artificial.
C. specific.
D. non-specific.
E. active.
F. passive.

Task 2.

An experiment was conducted in order to check whether virulence can be transferred between bacterial strains. During the test, mice were infected with two strains of pneumococci causing pneumonia: virulent (the S strain) and non-virulent (the R strain). The drawing below shows the course of the experiment and its results.

Sample 1	Sample 2	Sample 3	Sample 4
			
injection of the R strain cells	injection of the S strain cells	injection of the heat-killed S strain cells	injection of the R strain cells and the killed S strain cells
			
mouse survived	mouse died	mouse survived	mouse died

Source: F. Griffith, *The Significance of Pneumococcal Types*, "Journal of Hygiene" 27(2), 1928; E. Salomon, L. Berg, D. Martin, *Biologia*, Warszawa 2014.

Task 2.1. (0–1)

Complete the sentence below. Choose and mark the correct answer A, B or C and the correct answer from numbers 1–3.

The R strain became virulent as a result of

A.	conjugation,	which consists in	**1.**	the transfer of genetic material directly between two bacterial cells.
B.	transduction,		**2.**	uptaking genetic material from the external environment.
C.	transformation,		**3.**	the transfer of genetic material between bacterial cells by a virus.

Task 2.2. (0–1)

Determine which sample in the above experiment was the experimental sample. Give the reasoning behind your answer.

Experimental sample No.: .....

Reasoning: .....

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Task 3. (0–2)

Students conducted the following experiment: they peeled a potato tuber and cut out nine identical oblong pieces from it. They measured the length of each piece and recorded the results. Next, they took three beakers, added 100 ml of distilled water to each of them, and prepared three variants of the experiment:

- I – one beaker contained only distilled water;
- II – in one of the beakers, 4 g of table salt was dissolved in water;
- III – in one of the beakers, 10 g of table salt was dissolved in water.

The students placed three pieces of the potato tuber in each beaker and left the samples for two hours. After that time, they measured the length of the studied pieces again. It turned out that only in one beaker the length of the pieces of the potato tuber did not change. In the two remaining beakers the pieces changed their length: in one beaker they became shorter, and in the other one – they became longer.

Determine in which variant of the experiment the pieces of the potato tuber became shorter and in which variant of the experiment their length remained unchanged. Give the reasoning behind your answer by referring to the phenomenon of osmosis.

The pieces of the potato tuber became shorter in variant: .....

Reasoning: .....

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The length of the pieces of the potato tuber remained unchanged in variant: .....

Reasoning: .....

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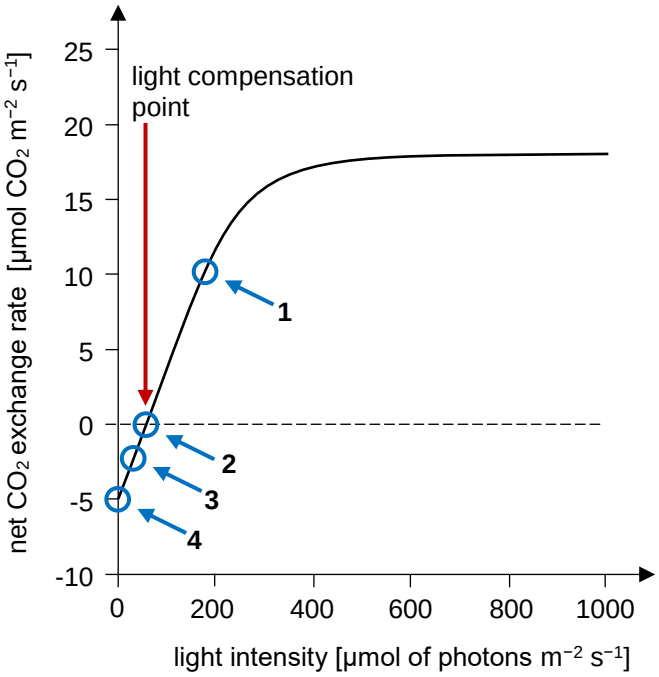
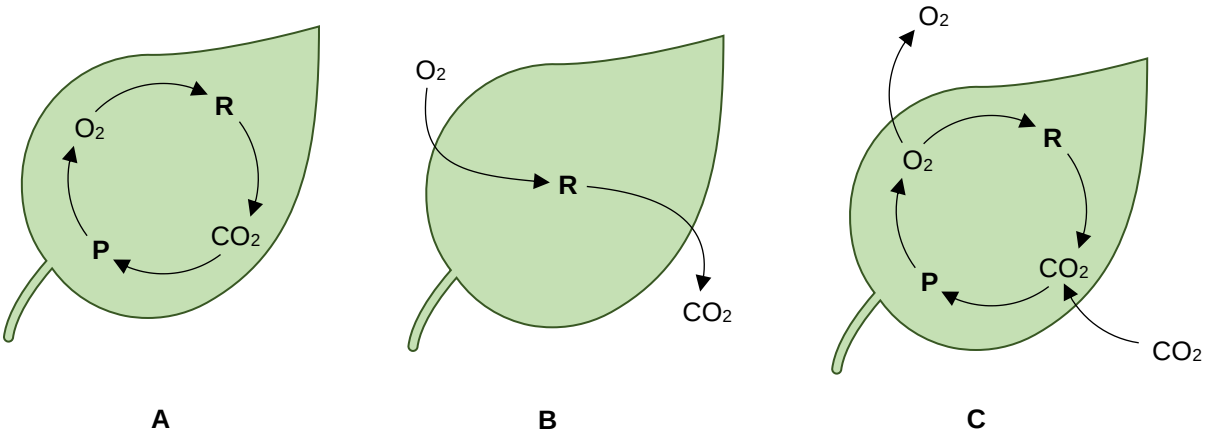
Task 4.

A plant assimilates CO_2 in the process of photosynthesis and produces CO_2 in the processes of intracellular respiration and photorespiration. The intensity of photosynthesis depends on environmental factors, e.g. on light intensity. The light compensation point is the level of light intensity at which the processes of assimilation and production of CO_2 by a plant are equal. The graph below shows the net CO_2 exchange rate between a plant and the environment, relative to light intensity.



The diagrams below (A–C) show gas exchange of leaves in various light conditions. The letters correspond to the processes that take place in leaves: P – photosynthesis, R – intracellular respiration.



A **B** **C**

Source: A. Bresinsky et al., *Strasburger's Plant Sciences*, Heidelberg 2013; ebooks.dynamic-learning.co.uk

Task 4.1. (0–1)

Match each diagram of leaf gas exchange (A–C) with the appropriate point on the curve on the graph that shows the net CO_2 exchange rate relative to light intensity (1–4).

A. ..... B. ..... C. .....

Task 4.2. (0–1)

Explain why at high light intensity, despite its further increase, the balance of CO_2 exchange between a plant and the environment remains at the same level.

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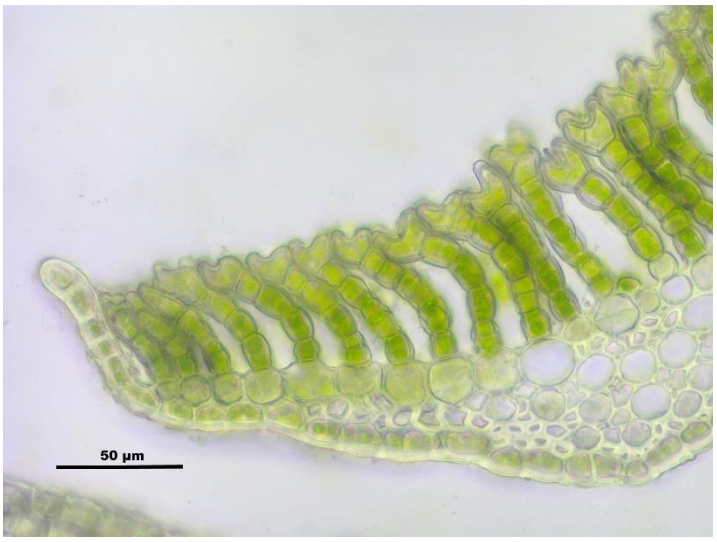
Task 5.

Mosses growing on the forest floor have a retention function: they absorb large amounts of water, retain it for a long time, and limit its evaporation from the groundcover surface. Thus, the soil maintains its proper humidity.

Leafy-stemmed gametophytes of mosses usually form dense mats. The photograph below, taken with an optical microscope, shows the cross section of a leaf belonging to the common haircap moss.



Source: Z. Podbielkowski, I. Rejment-Grochowska, A. Skirgiełło, *Rośliny zarodnikowe*, Warszawa 1986; photograph: Wikimedia Commons.

Task 5.1. (0–1)

Demonstrate the relationship between the structure of moss gametophytes and the retention function of mosses in the environment.

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Task 5.2. (0–1)

The photographs below (1–5) show five different plant species.

Note: The photographs are not to scale.

1

2

3

4

5

Photographs: Wikimedia Commons.

Give the numbers of two species that belong to mosses.

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Task 6. (0–3)

The photographs below (A–D) show four different species of vertebrate.

Note: The photographs are not to scale.

A. house sparrow

B. common toad

C. grass snake

D. western barbastelle

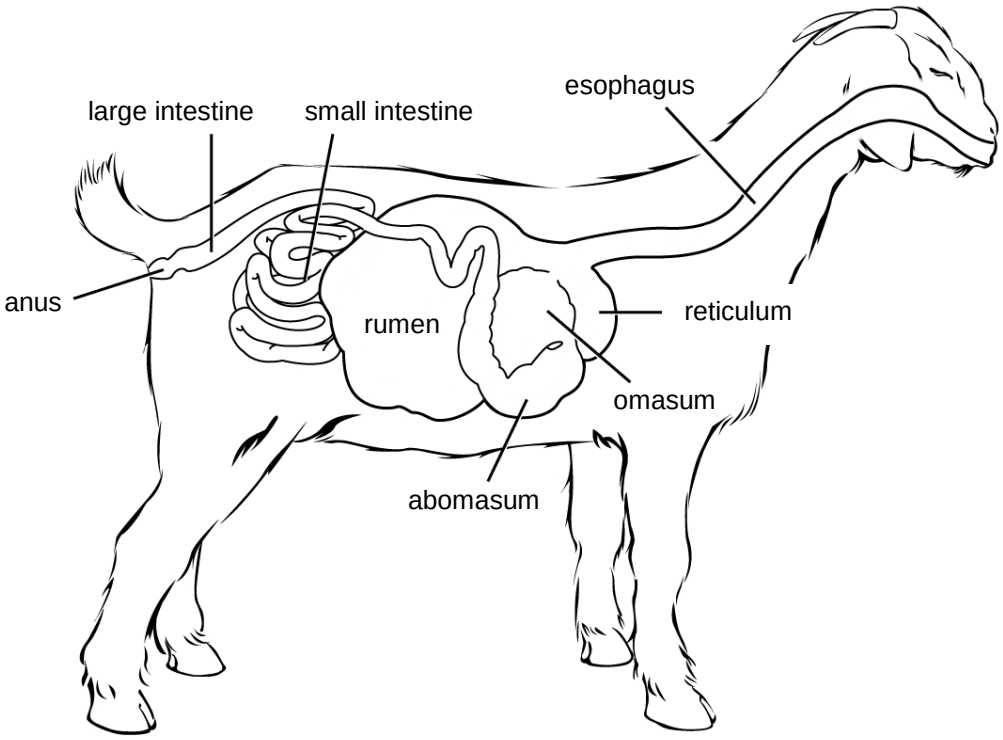
Photographs: Wikimedia Commons.

Complete the table below. In each row of the table write the appropriate letters (A–D) of all the animal species belonging to a given group.

Animal group	**Letters for animal species**
Triploblastic animals	
Amniotes	
Warm-blooded animals	
Pulmonate animals	

Task 7. (0–2)

The drawing below shows the structure of the digestive tract of a ruminant.



Source: opened.cuny.edu

Based on the drawing, give the names of two structural features that are adaptations to herbivory and determine the adaptive value of each of these features.

1. .....

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2. .....

.....

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Task 8.

The diagram below shows the stages of genetic information flow from gene to peptide in eukaryotic cells.

Exon sequences are underlined and marked in bold. Each of the three exons contains a single codon.

Stage	Molecule		Sequence	
	I. encoding DNA strand	5′	**ATG**GTCAAGCAAG**GGG**GTCAAGCAAG**CCC**…	3′
1.	↓			
	II. pre-mRNA	5′	**AUG**GUCAAGCAAG**GGG**GUCAAGCAAG**CCC**…	3′
2.	↓			
	III. mRNA	5′	……	3′
3.	↓			
	IV. peptide	NH_2	……	COOH

Task 8.1. (0–2)

Complete the diagram above. Write the nucleotide sequence of mRNA and the amino acid sequence of the encoded peptide.

Task 8.2. (0–1)

Give the names of the stages of genetic information expression marked on the diagram with numbers 1–3.

1. ..... 2. ..... 3. .....

Task 8.3. (0–1)

Demonstrate that one gene may encode peptides which differ in the amino acid sequence. In your answer, take into account the post-transcriptional modification of pre-mRNA.

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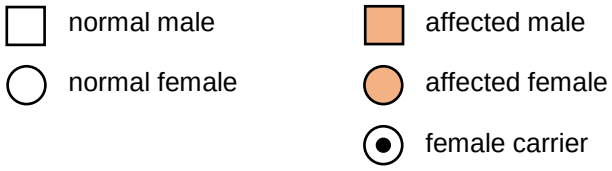
Task 9.

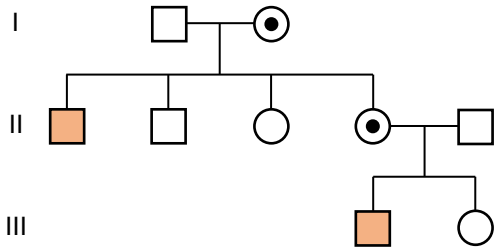
Haemophilia is a disease inherited in a sex-linked recessive pattern. Healthy parents had two children. One child was affected by haemophilia. It is known that one of the mother's brothers had haemophilia, while the other brother and sister were healthy.

When writing a pedigree, the following symbols are used:

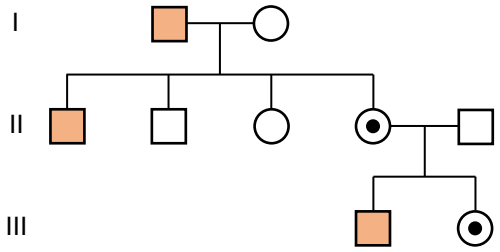


Task 9.1. (0–1)

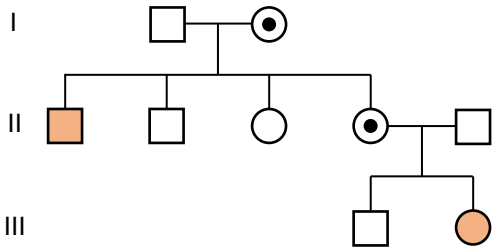
Which of the following pedigree charts (A–D) properly describes the history of the presented family? Select and mark the correct answer from the pedigrees given below.



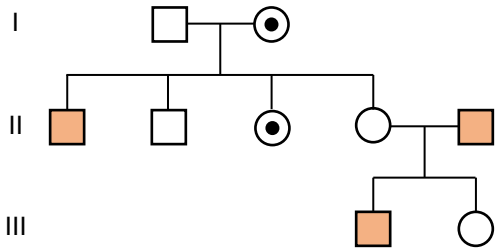
A



B



C



D

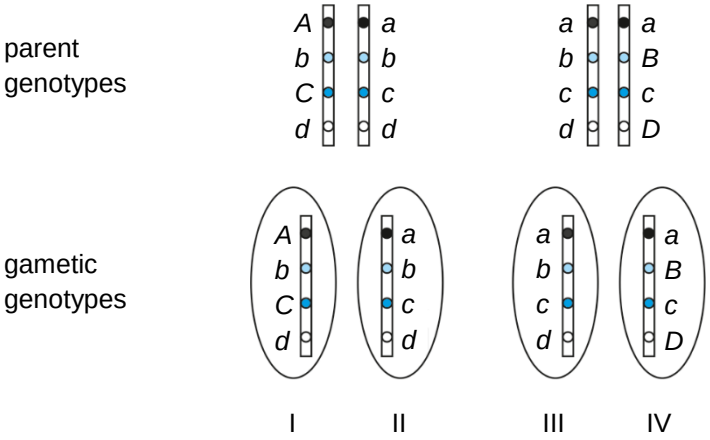
Task 9.2. (0–1)

What is the probability that the next child of these parents will have haemophilia? Select the correct answer from the options given below.

A. 0% **B.** 25% **C.** 50% **D.** 100%

Task 10. (0–1)

The diagram below shows the polygenic inheritance of skin pigmentation degree in humans. This feature is determined by four genes: *A*, *B*, *C*, and *D*. The dominant alleles of these genes, designated by capital letters, determine darker skin pigmentation.



Source: G. Drewa, T. Ferenc, *Genetyka medyczna. Podręcznik dla studentów*, Wrocław 2011.

Give the symbols of two gametes (I–IV) whose combination will lead to the formation of the genotype determining the darkest possible skin pigmentation.

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NOTES *(not subject to evaluation)*

BIOLOGIA

Poziom rozszerzony

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