

External assessment 2025

Multiple choice question book

Biology

Paper 1

General instruction

- Work in this book will not be marked.

Section 1

Instruction

- Respond to these questions in the question and response book.
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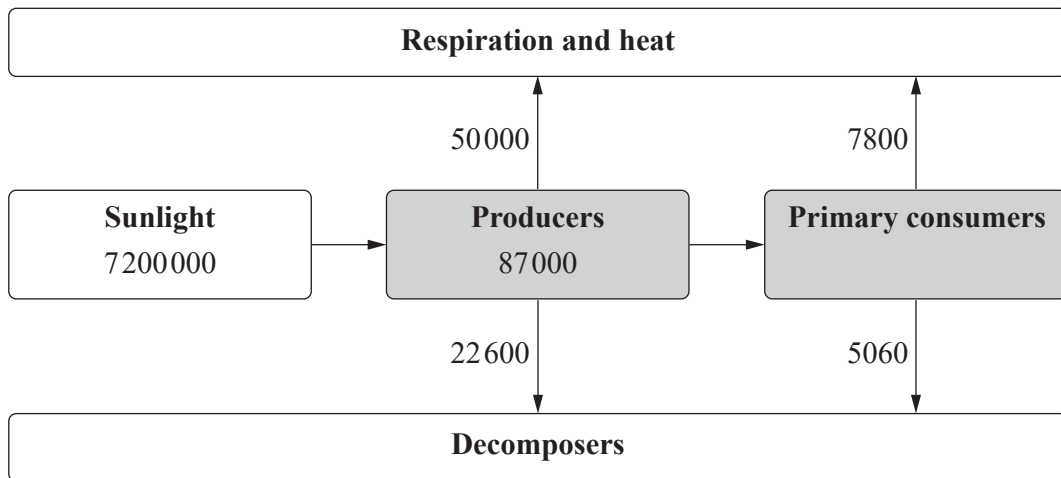
QUESTION 1

Which base pairs with adenine during DNA replication?

- (A) uracil
- (B) guanine
- (C) thymine
- (D) cytosine

QUESTION 2

The diagram shows energy flow through an ecosystem in $\text{kJ m}^{-2} \text{ year}^{-1}$. Shaded boxes represent gross productivity.



Calculate the percentage of solar energy available to primary consumers.

- (A) 0.1%
- (B) 0.2%
- (C) 0.4%
- (D) 0.5%

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QUESTION 3

As a population approaches its carrying capacity, the population growth rate will

- (A) increase due to intraspecific competition.
- (B) increase due to interspecific competition.
- (C) decrease due to intraspecific competition.
- (D) decrease due to interspecific competition.

QUESTION 4

What is the role of tRNA in protein synthesis?

- (A) acting as a template strand for mRNA
- (B) matching amino acids to mRNA codons
- (C) transporting mRNA from the nucleus to the ribosome
- (D) providing a copy of genetic instructions for the ribosome

QUESTION 5

Which option describes the contents of a human cell at metaphase I of meiosis?

	Number of chromosomes	Number of copies of each gene
(A)	23	1
(B)	23	2
(C)	46	2
(D)	46	4

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QUESTION 6

A student investigating the impact of a selection pressure on a population collected the data shown.

Genotype	BB	Bb	bb
Number of individuals	128	220	85

Calculate the frequency of the recessive allele in the population.

- (A) 10%
- (B) 20%
- (C) 32%
- (D) 45%

QUESTION 7

Which process is involved in both carbon and water cycling?

- (A) respiration
- (B) evaporation
- (C) transpiration
- (D) precipitation

QUESTION 8

Speciation is more likely to occur between two populations when

- (A) gene flow is low and selection pressures are similar.
- (B) gene flow is high and selection pressures are similar.
- (C) gene flow is low and selection pressures are different.
- (D) gene flow is high and selection pressures are different.

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QUESTION 9

Which term describes large, geographically distinct areas of Earth's surface with common climates, geology, landforms and communities?

- (A) niches
- (B) ecoregions
- (C) environments
- (D) microhabitats

QUESTION 10

In humans, sex-linked recessive traits are more common in

- (A) males, because they have a Y chromosome.
- (B) females, because they have two X chromosomes.
- (C) males, because they have only one X chromosome.
- (D) females, because they do not have a Y chromosome.

QUESTION 11

A student surveying a forest community collected the data shown.

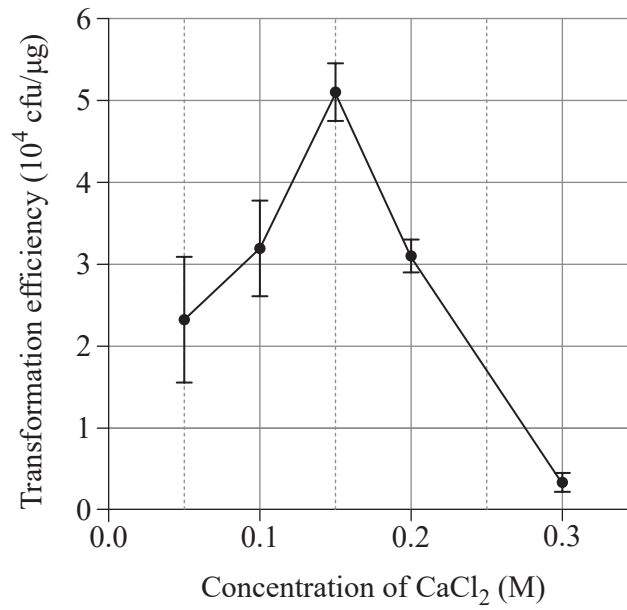
Species	Number of individuals
W	220
X	123
Y	62
Z	145

Calculate the relative abundance of species W.

- (A) 0.22
- (B) 0.25
- (C) 0.40
- (D) 0.67

QUESTION 12

An experiment was conducted to determine how the concentration of calcium chloride (CaCl_2) affects the transformation efficiency of plasmids. Error bars show standard error.



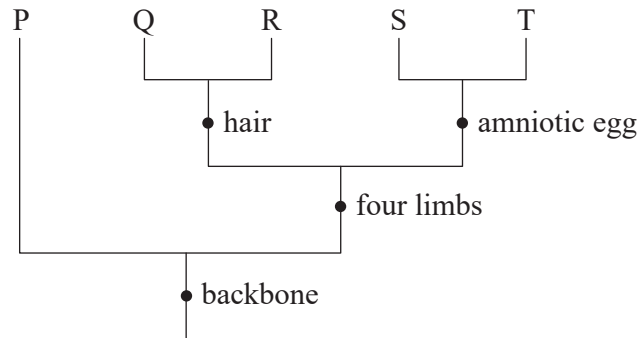
Which concentration had the greatest variation in transformation efficiency?

- (A) 0.05 M
- (B) 0.15 M
- (C) 0.20 M
- (D) 0.30 M

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QUESTION 13

The cladogram shows relationships for species P, Q, R, S and T.



What inference can be drawn?

- (A) Species Q, R and S form a clade.
- (B) Species P and R are more closely related than species P and T.
- (C) The most recent common ancestor of species R and T had four limbs.
- (D) Species Q and R have a more recent common ancestor than species S and T.

QUESTION 14

Which species concept is based on common ancestry?

- (A) biological
- (B) ecological
- (C) phylogenetic
- (D) morphological

QUESTION 15

Which technique identifies the order of bases in DNA?

- (A) DNA profiling
- (B) DNA sequencing
- (C) gel electrophoresis
- (D) polymerase chain reaction

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QUESTION 16

The table shows haploid (n) and diploid ($2n$) chromosome numbers for different matings.

Mating	Female	Male
I	$n = 32$	$2n = 62$
II	$2n = 62$	$n = 31$
III	$n = 31$	$2n = 62$
IV	$2n = 64$	$n = 32$

Predict which mating would produce an interspecific hybrid.

- (A) I
- (B) II
- (C) III
- (D) IV

QUESTION 17

Which mode of evolution involves the development of complementary characteristics in two species experiencing a close and long-term interaction?

- (A) coevolution
- (B) parallel evolution
- (C) divergent evolution
- (D) convergent evolution

QUESTION 18

Which mutation is likely to have the greatest effect on the viability of an embryo?

- (A) a point mutation in a HOX gene
- (B) a point mutation in the SRY gene
- (C) a frameshift mutation in a HOX gene
- (D) a frameshift mutation in the SRY gene

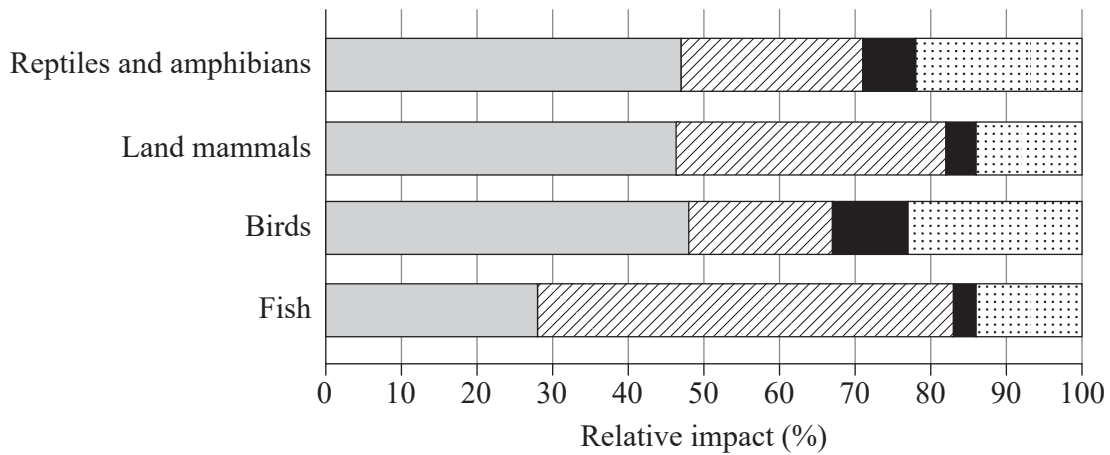
QUESTION 19

Which process involves the random alignment and separation of homologous chromosomes to form unique combinations of maternal and paternal chromosomes in gametes?

- (A) cytokinesis
- (B) crossing over
- (C) recombination
- (D) independent assortment

QUESTION 20

The graph shows the relative impact of habitat destruction, overexploitation, pollution and other human activities on four taxonomic groups.



Which activity has the greatest impact on terrestrial ecosystems?

- (A) habitat destruction
- (B) overexploitation
- (C) pollution
- (D) other

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References

Question 12

Lim, G; Lum, D; Ng, B & Sam, C 2015, 'Differential transformation efficiencies observed for pUC19 and pBR322 in e. coli may be related to calcium chloride concentration', Journal of Experimental Microbiology and Immunology (JEMI), vol. 19, <https://jemi.microbiology.ubc.ca/sites/default/files/Lim%20et%20al.pdf>

Question 13

StackExchange 2017, 'Example of impossibility in the nested heirarchy?', Biology, <https://biology.stackexchange.com/questions/65364/example-of-impossibility-in-the-nested-hierarchy>

Question 20

WWF. 2018. Living Planet Report - 2018: Aiming Higher. Grooten, M. and Almond, R.E.A.(Eds). WWF, Gland, Switzerland. https://c402277.ssl.cf1.rackcdn.com/publications/1187/files/original/LPR2018_Full_Report_Spreads.pdf

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