

External assessment 2022

Multiple choice question book

Biology

Paper 1

General instruction

- Work in this book will not be marked.

Section 1

Question 1

What is the molecular unit of heredity?

- (A) gene
- (B) genome
- (C) nucleotide
- (D) chromosome

Question 2

Which stage of making recombinant DNA requires DNA ligase?

- (A) cutting
- (B) joining
- (C) isolation
- (D) transformation

Question 3

A survey of grasshopper species was conducted across four eucalypt communities. Counts were conducted and the average abundance per 400 m² recorded.

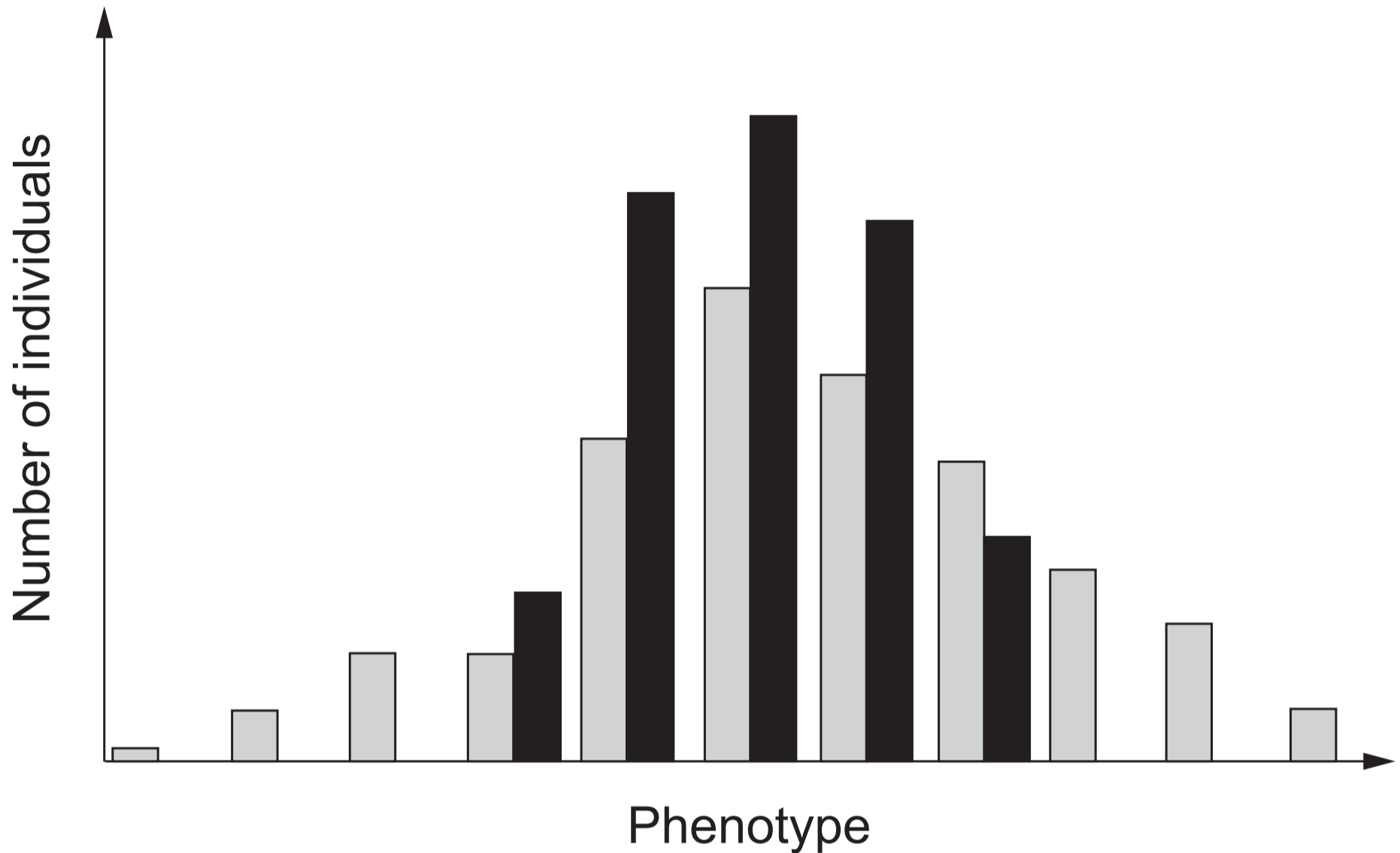
| Grasshopper species (A–F) | | | | | | | |
|---------------------------|----|----|----|----|----|----|-------|
| Community | A | B | C | D | E | F | Total |
| I | 32 | 18 | 1 | 3 | 0 | 46 | 100 |
| II | 3 | 2 | 0 | 1 | 3 | 12 | 21 |
| III | 3 | 2 | 28 | 3 | 18 | 51 | 105 |
| IV | 18 | 13 | 12 | 14 | 16 | 15 | 88 |

Which community has both the highest species richness and highest evenness for grasshoppers?

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

Question 4

The graph shows the effect of a selection pressure on a hypothetical population.



Key

- Before the selection pressure
- 20 generations later

Which mode of phenotypic selection corresponds with the data?

- (A) negative
- (B) disruptive
- (C) stabilising
- (D) directional

Question 5

A researcher captured, marked and released 36 frogs. The following day they captured 24 frogs and 18 were marked.

Calculate the approximate size of the frog population using

the Lincoln index: $N = \frac{M \times n}{m}$

- (A) 27
- (B) 48
- (C) 54
- (D) 60

Question 6

The role of helicase in DNA replication is to

- (A) initiate the process by binding to recognition sites along the template strand.
- (B) add complementary bases to the template strand.
- (C) unwind and separate DNA strands.
- (D) join DNA strands together.

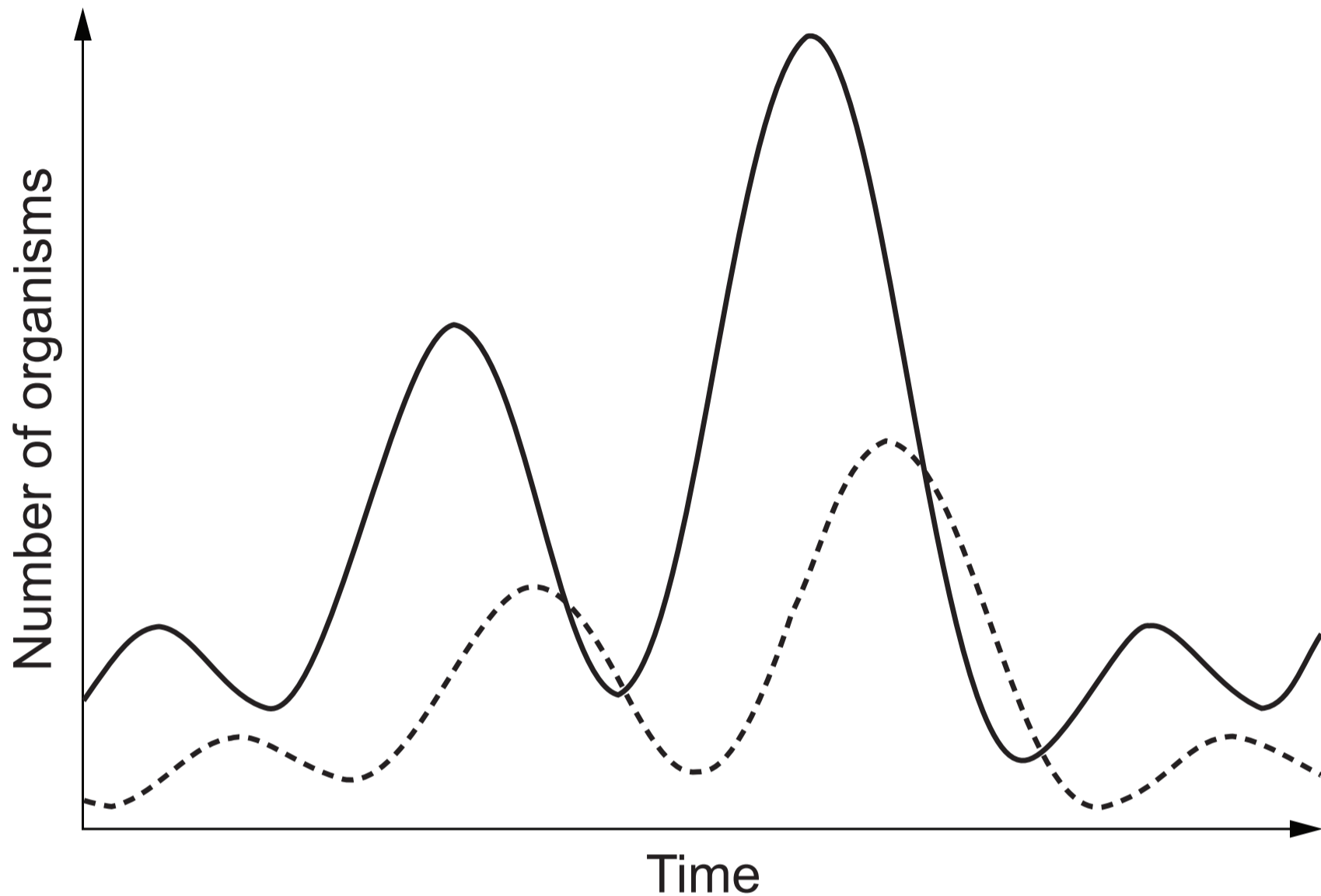
Question 7

What is used directly by plants for protein synthesis?

- (A) nitrite, NO_2^-
- (B) nitrate, NO_3^-
- (C) ammonia, NH_3
- (D) atmospheric nitrogen, N_2

Question 8

The graph shows how the populations of two species in an ecosystem change over time.



Key

- Species X
- - - Species Y

Which species interaction is represented?

- (A) predation, where species X preys on species Y
- (B) predation, where species Y preys on species X
- (C) competition, where species X outcompetes species Y
- (D) competition, where species Y outcompetes species X

Question 9

Polygenic inheritance involves multiple

- (A) alleles for a single gene.
- (B) genes with the same alleles.
- (C) genes coding for a single characteristic.
- (D) characteristics resulting from a single gene.

Question 10

Wings in birds, bats and pterosaurs are phenotypically similar, though they belong to different families and do not have a common ancestor with the trait. While the general morphology is similar, the structure and organisation of each wing is different.

This is an example of

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

Question 11

Evolutionary relationships were investigated by sequencing a section of protein from five different species. Each letter represents an amino acid.

| | | | | | | | | | | | | | |
|--------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species I | D | E | V | G | W | E | A | L | G | R | L | V | S |
| Species II | D | E | V | G | W | E | G | L | G | R | A | V | S |
| Species III | D | E | A | G | S | E | G | L | A | R | L | E | S |
| Species IV | D | E | V | G | S | E | G | L | G | R | L | E | S |
| Species V | D | E | V | G | W | E | A | L | A | R | L | V | S |

It can be inferred that Species I is most closely related to

- (A) Species II.
- (B) Species III.
- (C) Species IV.
- (D) Species V.

Question 12

Speciation occurs when

- (A) the gene pool of an existing species becomes too small to support a viable population.
- (B) selection pressures cause significant changes to the allele frequencies of a population.
- (C) genetic drift is no longer occurring within populations.
- (D) gene flow is no longer occurring between populations.

Question 13

An error during DNA replication resulted in the following change to mRNA transcripts.

| | |
|-------------|------------------------------------|
| mRNA before | AUGAAGUUUGGCAUC ... (continued) |
| mRNA after | AUGAAGUUUGCAUCG ... (continued) |

The DNA replication error most likely involved

- (A) deletion of cytosine.
- (B) insertion of guanine.
- (C) substitution of uracil with guanine.
- (D) substitution of guanine with cytosine.

Question 14

Prior to fertilisation, a secondary oocyte will arrest at which stage of meiosis?

- (A) prophase I
- (B) prophase II
- (C) metaphase I
- (D) metaphase II

Question 15

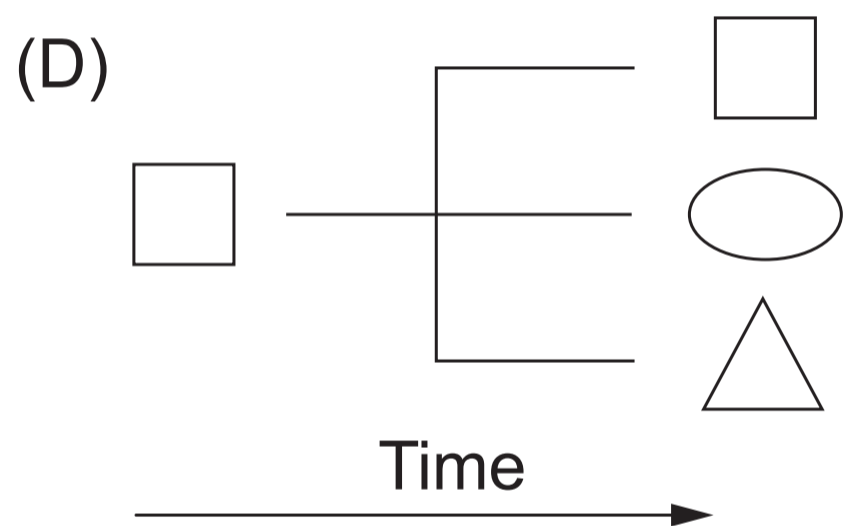
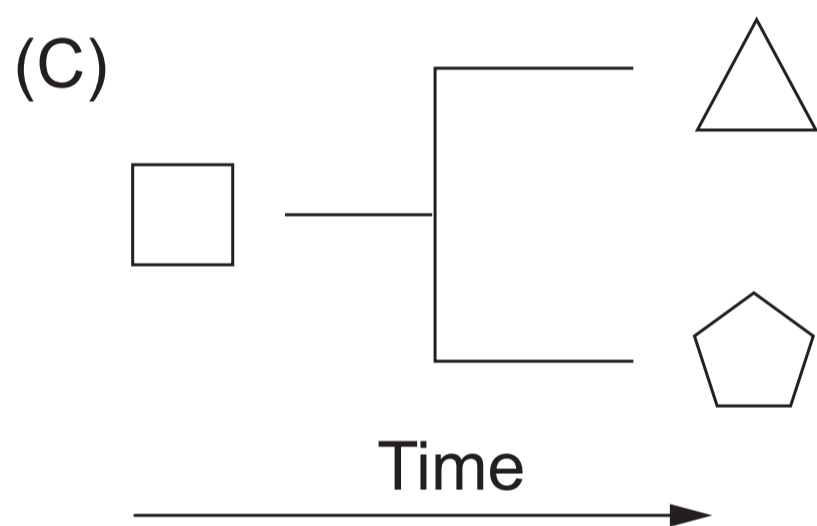
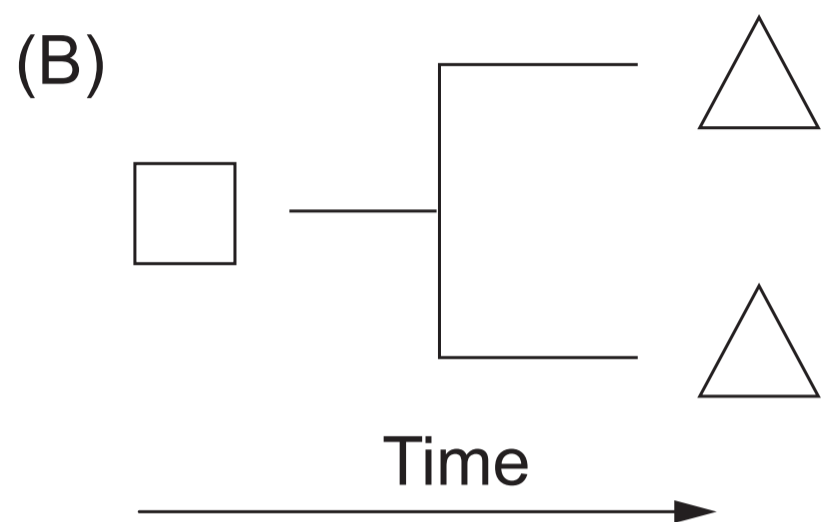
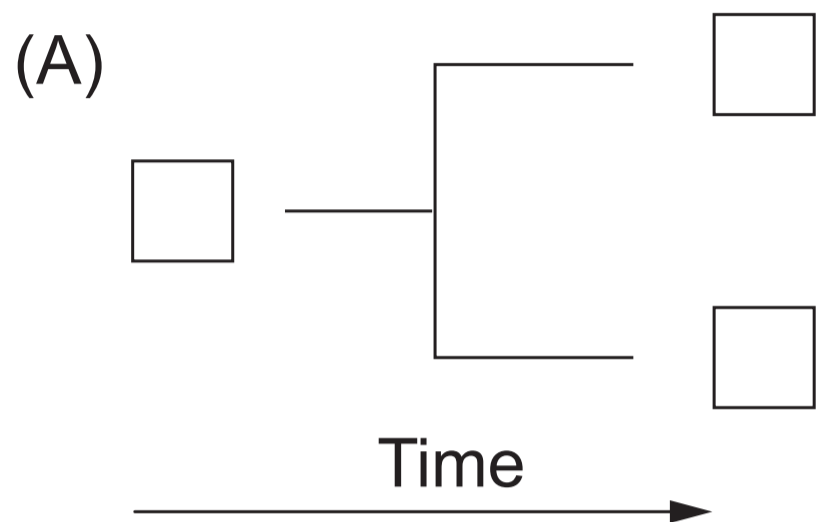
The environment's influence on gene expression can be investigated by comparing the rate of concordance in monozygotic (identical) and dizygotic (non-identical) twins. Concordance occurs when both twins express a trait.

Strong environmental influence is suspected when concordance is

- (A) higher in monozygotic twins.
- (B) only observed in dizygotic twins.
- (C) only observed in monozygotic twins.
- (D) similar in monozygotic and dizygotic twins.

Question 16

If each shape represents a different species, which diagram shows the common assumptions of cladistics?



Question 17

Students used quadrats to investigate biodiversity in a grassland community with scattered distribution of plant species. The students agreed on a counting criteria for each quadrat to

- (A) reduce the time taken to count the different species.
- (B) minimise statistical uncertainty.
- (C) ensure all strata were sampled.
- (D) minimise bias.

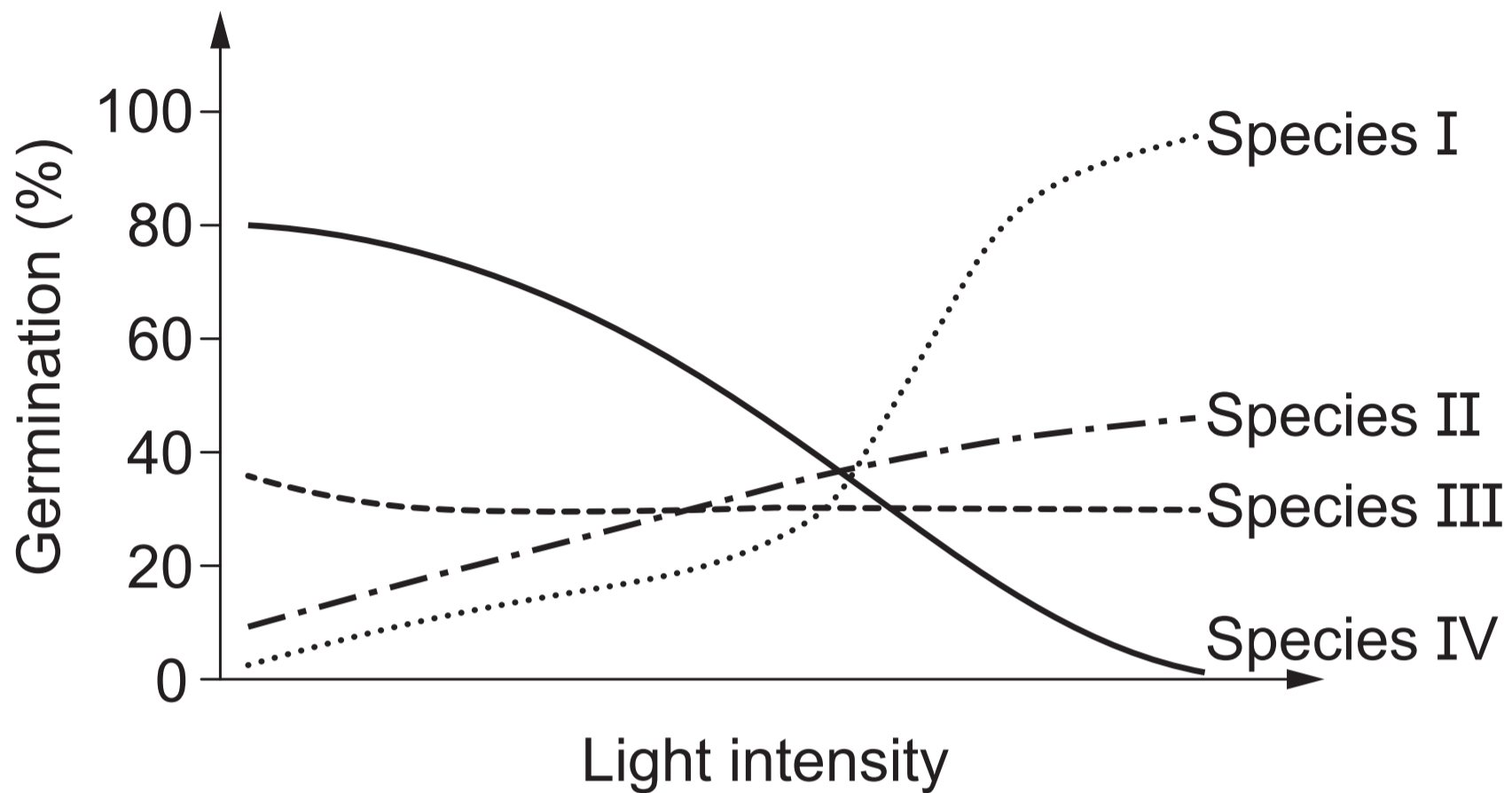
Question 18

The competitive exclusion principle applies to different species occupying the same

- (A) niche.
- (B) habitat.
- (C) environment.
- (D) trophic level.

Question 19

The graph shows the effect of light intensity on the germination success of seeds from four plant species.



Which is most likely to be a pioneer species?

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

Question 20

A section of DNA is made up of two strands, I and II.

| Base | Strand I composition | Strand II composition |
|----------|----------------------|-----------------------|
| adenine | | |
| cytosine | | 25% |
| guanine | | 14% |
| thymine | 29% | |

It can be inferred that

- (A) strand I contains 25% cytosine.
- (B) strand I contains 32% adenine.
- (C) strand II contains 29% thymine.
- (D) strand II contains 71% adenine.

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References

Question 8

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