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Sample assessment 2020

Multiple choice question book

Biology

Paper 1



Queensland
Government



Queensland Curriculum
& Assessment Authority

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Section 1

Instructions

- Answer all questions in the question and response book.
 - This book will not be marked.
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QUESTION 1

Female Komodo dragons (*Varanus komodoensis*), in the absence of a mate, can produce offspring in which the growth and development of the embryo can occur without the joining of gametes.

Identify which of the following methods of reproduction would be used to classify this species.

- (A) binary fission
- (B) parthenogenesis
- (C) internal fertilisation
- (D) external fertilisation

QUESTION 2

An investigation surveyed a land zone that had

- high precipitation rates
- an open canopy forest with tall emergents
and
- a well-developed understorey of ferns, palms and sclerophyll shrubs.

The dominant forest tree species were

- flooded gum (*Eucalyptus grandis*)
- Sydney blue gum (*Eucalyptus saligna*)
- red mahogany (*Eucalyptus resinifera*)
and
- brush box (*Lophostemon confertus*).

A dominant vegetation community classification system would classify this ecosystem as a

- (A) rainforest.
- (B) eucalypt woodland.
- (C) eucalypt open forest.
- (D) wet eucalypt open forest.

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QUESTION 3

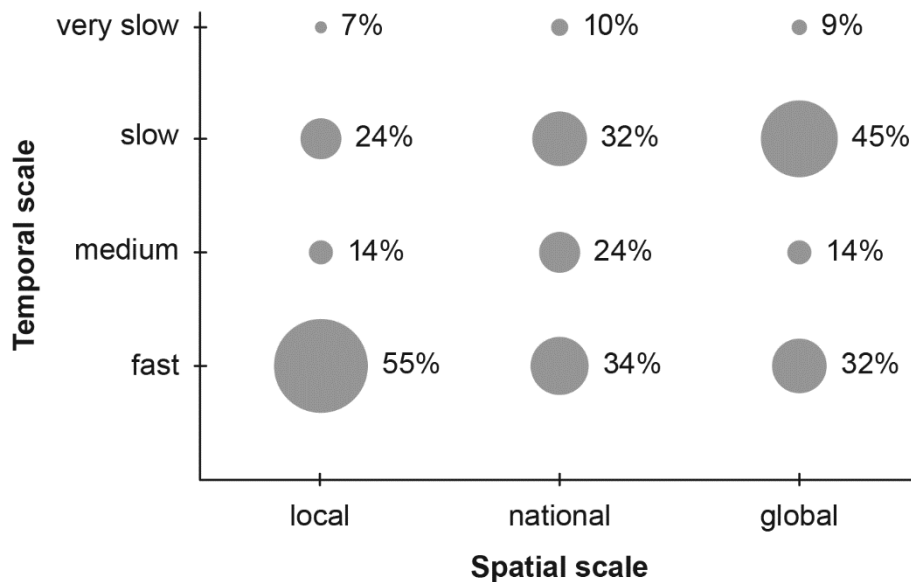
In 1978, a population of a migratory shore bird was estimated at 90 000 individuals. An analysis of monitoring data in 2018 showed the population is now at 50 000.

The change in population growth for this species is

- (A) -29%
- (B) -44%
- (C) -55%
- (D) -80%

QUESTION 4

This figure shows the relationship between spatial and temporal scale of drivers of ecosystem change. The size of the circles represents the proportion of drivers at a certain spatial scale that had a certain speed.



Agricultural intensification along a river has led to substantial increases in fertiliser application and increases in stock numbers. From the given data, predict the speed of ecosystem change along this river.

- (A) fast
- (B) medium
- (C) slow
- (D) very slow

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QUESTION 5

Identify which of the following is a factor that regulates phenotypic expression of genes during translation.

- (A) activator
- (B) repressor
- (C) promoter
- (D) microRNA

QUESTION 6

Which of the following does **not** cause macroevolution?

- (A) time
- (B) mutation
- (C) extinction
- (D) speciation

QUESTION 7

The main purpose of gene expression is to

- (A) transcribe a gene.
- (B) produce hormones.
- (C) maintain homeostasis.
- (D) synthesise a functional gene product.

QUESTION 8

Which feature makes pioneer species effective colonisers?

- (A) large seeds
- (B) slow-growth rate
- (C) shade-tolerant seedlings
- (D) ability to fixate nitrogen

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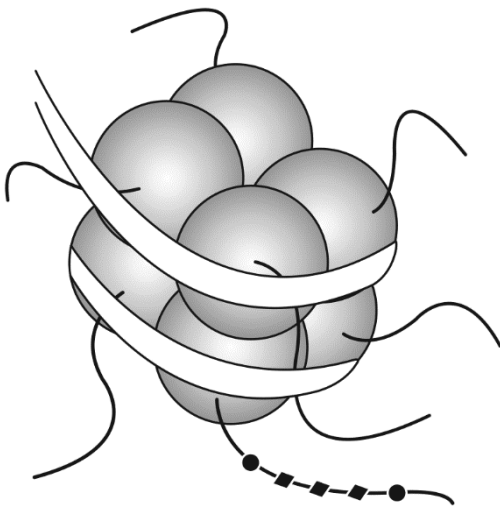
QUESTION 9

Which of the following is a biotechnological application of DNA profiling?

- (A) gene therapy
- (B) food security
- (C) drug discovery
- (D) epigenetic analysis

QUESTION 10

This figure is an example of a structure found in DNA.



Select the option that best represents the figure.

- (A) histone
- (B) nucleus
- (C) chromatin
- (D) nucleosome

QUESTION 11

A group of genes that control the pattern of body formation in humans is being investigated. A gene that would be part of this group is the

- (A) HOX (homeotic sub-group) gene.
- (B) TDF (testis-determining factor) gene.
- (C) SRY (sex-determining region Y) gene.
- (D) PAX6 (regulatory gene of eye and brain) gene.

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QUESTION 12

Which symbiotic interaction occurs when one species is harmed and the other species benefits?

- (A) parasitism
- (B) mutualism
- (C) amensalism
- (D) commensalism

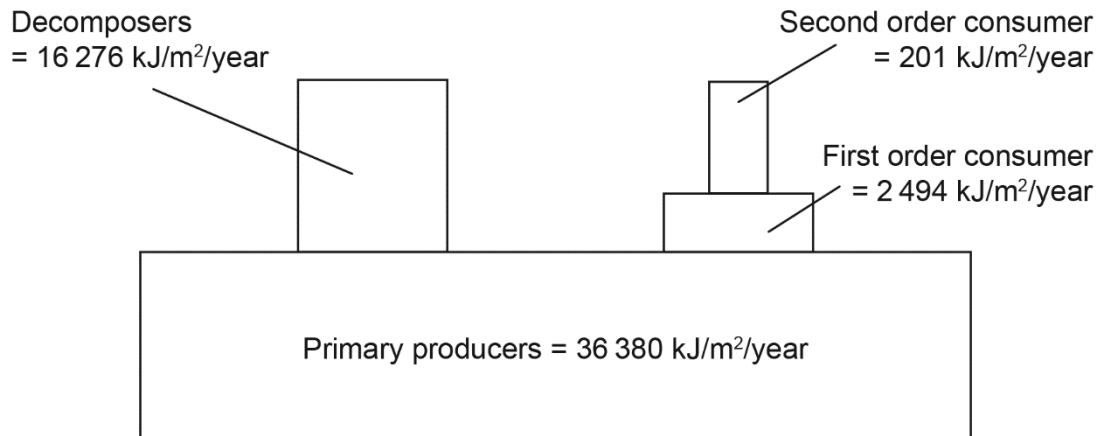
QUESTION 13

During meiosis II, what is the role of homologous chromosomes?

- (A) pairing
- (B) separation
- (C) duplication
- (D) recombination

QUESTION 14

This figure shows an energy pyramid for a hypothetical ecosystem.



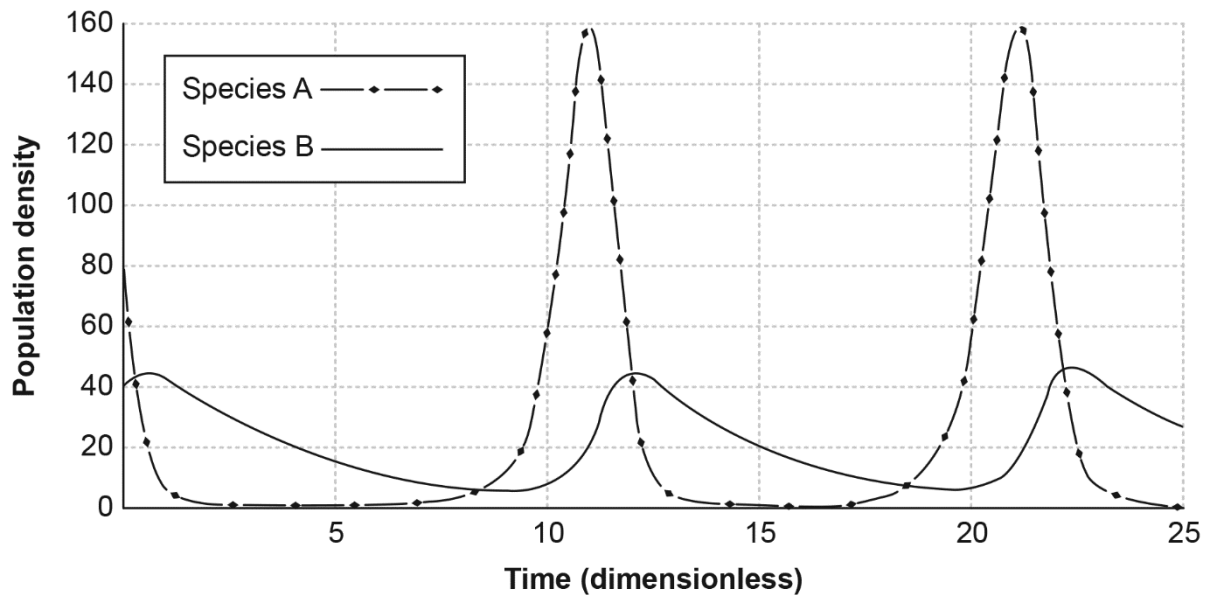
The trophic level transfer efficiency of primary producers to herbivores in this situation would be

- (A) 0.6%.
- (B) 6.9%.
- (C) 7.4%.
- (D) 44.7%.

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QUESTION 15

The figure below shows a model of two species populations, species A and species B, competing for the same resource over time.



Identify the response that describes the relationship between the two species over time.

- (A) species A competitively excludes species B
- (B) species B competitively excludes species A
- (C) there is no competitive exclusion, coexistence occurs between species
- (D) either species competitively excludes the other based on population densities

QUESTION 16

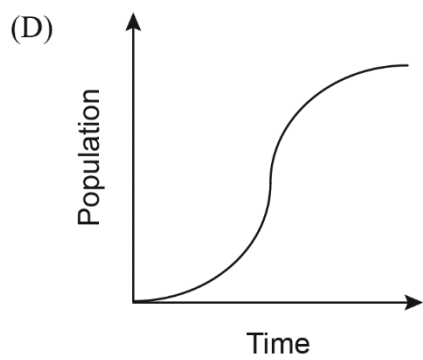
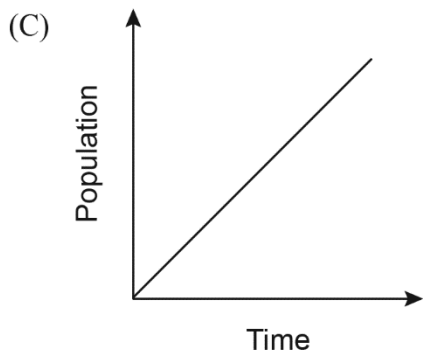
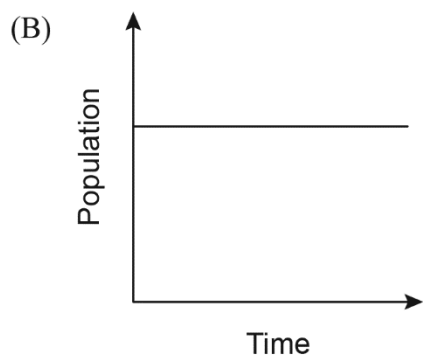
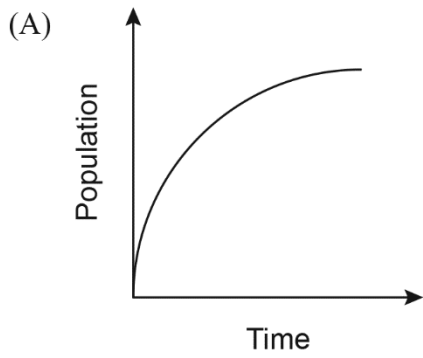
Haemoglobin gene expression is restricted to erythroid cells. This process is controlled by

- (A) mutation.
- (B) translation factors.
- (C) haemoglobin genes.
- (D) transcription factors.

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QUESTION 17

Which of the figures below represents a logistic population growth of a species over time?



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QUESTION 18

Evolution, during successive generations, is a change in the

- (A) small-scale variation of species' allele frequencies.
- (B) genetic transmission of characteristics.
- (C) genetic composition of a population.
- (D) divergence of taxonomic groups.

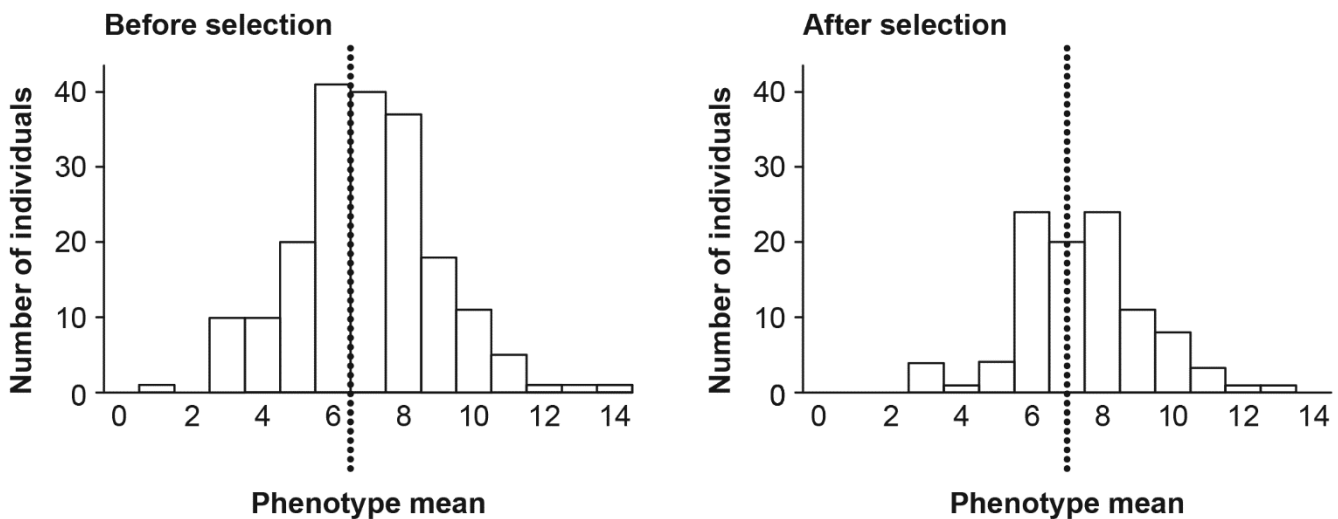
QUESTION 19

Polygenic inheritance is defined as

- (A) one characteristic controlled by one gene.
- (B) one characteristic controlled by multiple genes.
- (C) multiple characteristics controlled by one gene.
- (D) multiple characteristics controlled by multiple genes.

QUESTION 20

The graphs below show the trait distribution of a hypothetical population before and after selection. The dotted line indicates the mean of each population.



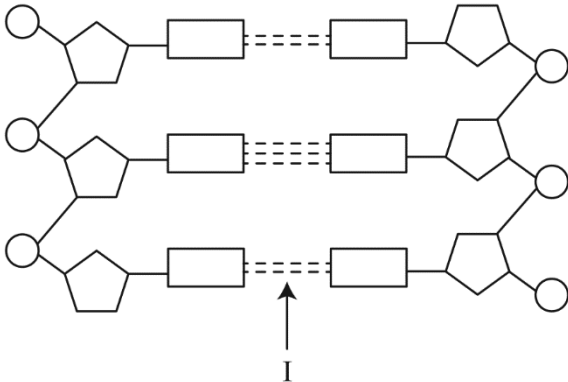
The type of phenotypic selection represented in the graphs is

- (A) divergent.
- (B) disruptive.
- (C) stabilising.
- (D) directional.

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QUESTION 21

The figure below represents a section of DNA.



Label I is a

- (A) nucleotide.
- (B) covalent bond.
- (C) hydrogen bond.
- (D) purine molecule.

QUESTION 22

Island populations are often isolated and can face an increased risk of extinction because of

- (A) improved reproductive fitness.
- (B) reduced genetic diversity.
- (C) decreased genetic drift.
- (D) unrestricted gene flow.

QUESTION 23

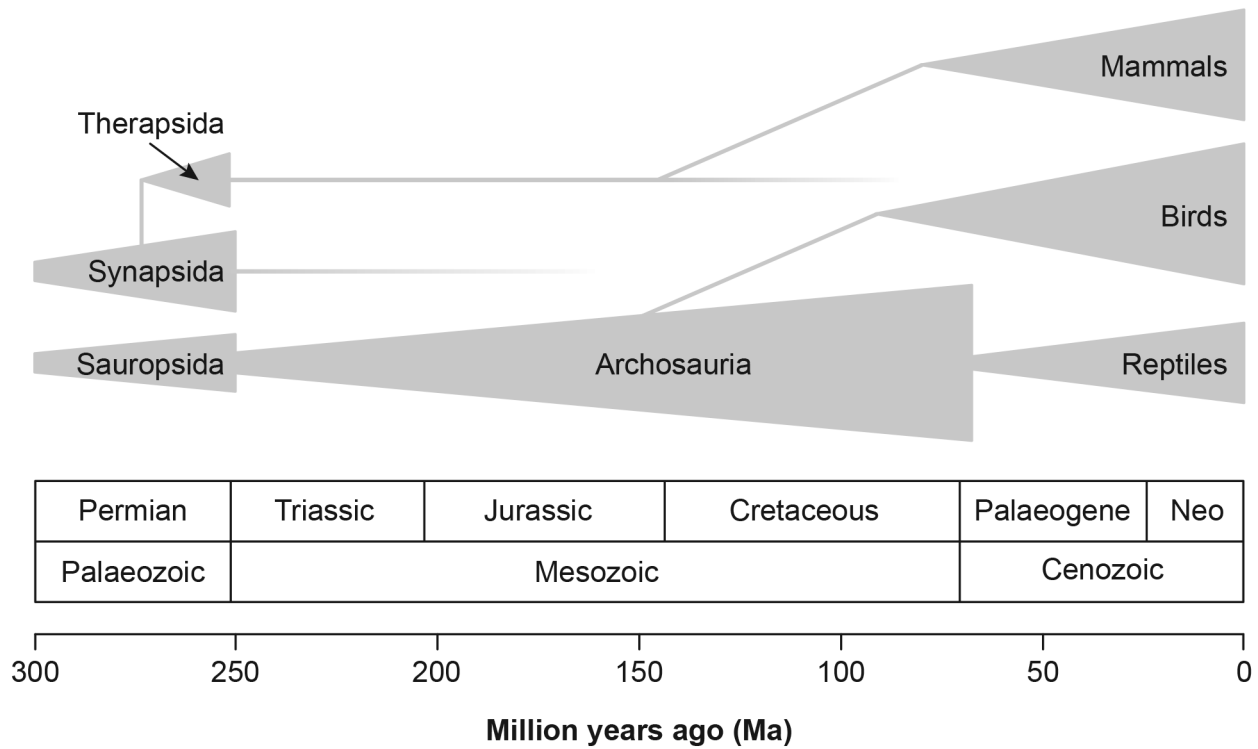
Transfer RNA (tRNA) is a type of molecule that helps decode a messenger RNA sequence into a protein. From this information, identify which group tRNA belongs to.

- (A) exons
- (B) introns
- (C) noncoding RNA
- (D) noncoding DNA

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QUESTION 24

The figure below shows an evolutionary timeline indicating episodes of evolutionary radiation.



In which period did the radiation of mammals occur?

- (A) Triassic
- (B) Jurassic
- (C) Cretaceous
- (D) Palaeogene

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QUESTION 25

The table below shows the probability of the replacement of one individual tree by another of the same or different species in 50 years' time.

Present occupant	Occupant in 50 years			
	Grey birch	Red maple	Blackgum	Beech
Grey birch	0.05	0.50	0.36	0.09
Red maple	0.00	0.53	0.14	0.31
Blackgum	0.01	0.25	0.57	0.17
Beech	0.00	0.03	0.01	0.96

Which species is most likely to replace grey birch in a 50-year temporal successional change in this forest?

- (A) grey birch
- (B) red maple
- (C) blackgum
- (D) beech

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References

Question 4

Figure derived from Millennium Ecosystem Assessment 2005, 'Chapter 7: Drivers of ecosystem change' in *Ecosystems and Human Well-being: Sub-global*, Millennium Assessment, World Resources Institute & Island Press, Washington, DC, 'Figure 7.4' at p. 156, www.millenniumassessment.org/documents/document.345.aspx.pdf.

Question 10

Image derived from Relton, CL & Davey Smith G 2010, 'Epigenetic epidemiology of common complex disease: Prospects for prediction, prevention, and treatment', *PLOS Med*, vol. 7, no. 10, www.ncbi.nlm.nih.gov/pmc/articles/PMC2964338/figure/pmed-1000356-g001, licensed under CC BY 4.0, <https://creativecommons.org/licenses/by/4.0>.

Question 14

Figure derived from Regents of the University of Michigan 2005, 'The Flow of Energy: Higher Trophic Levels', <https://globalchange.umich.edu/globalchange1/current/lectures/klings/energyflow/highertrophic/trophic2.html>.

Question 15

Figure derived from Elb2000 2007, 'File: Cheetah Baboon LV.jpg', https://en.wikipedia.org/wiki/File:Cheetah_Baboon_LV.jpg.

Question 20

Graphs derived from Kingsolver, JG & Pfennig, DW 2007, 'Patterns and power of phenotypic selection in nature', *BioScience*, vol. 57, no. 7, pp. 561–572, 'Figure 1' at p. 562, <https://pdfs.semanticscholar.org/1b12/26359de4cafa6ae4a360a68ae12530df71b7.pdf>.

Question 21

Figure derived from Clark, MA, Choi, J & Douglas, M 2018, *Biology 2e* (iBooks), OpenStax, Rice University, Houston, <https://openstax.org/details/books/biology-2e?Book%20details>.

Question 24

Figure modified from Gerkema, MP, Davies, WIL, Foster, RG, Menaker, M & Hut, RA 2013, 'The nocturnal bottleneck and the evolution of activity patterns in mammals', *Proceedings of the Royal Society B*, vol. 280, 'Figure 1' at p. 2, <https://doi.org/10.1098/rspb.2013.0508>. Used with permission.

Question 25

Table derived from Roxburgh, S 1996, 'Lecture 3: Environmental variability, succession and invasion', *Landscape Ecology and Population Dynamics*, p. 11, www.steverox.info/Downloads/Teaching/Succession%20&%20Invasion.pdf.

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Sample assessment 2020

Question and response book

Biology

Paper 1

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (25 marks)

- 25 multiple choice questions

Section 2 (25 marks)

- 5 short response questions



Section 1

Instructions

- Choose the best answer for Questions 1–25.
- This section has 25 questions and is worth 25 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	A	B	C	D
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2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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23.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 2

Instructions

- Write using black or blue pen.
 - Respond in paragraphs consisting of full sentences.
 - If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
 - This section has 5 questions and is worth 25 marks.
-

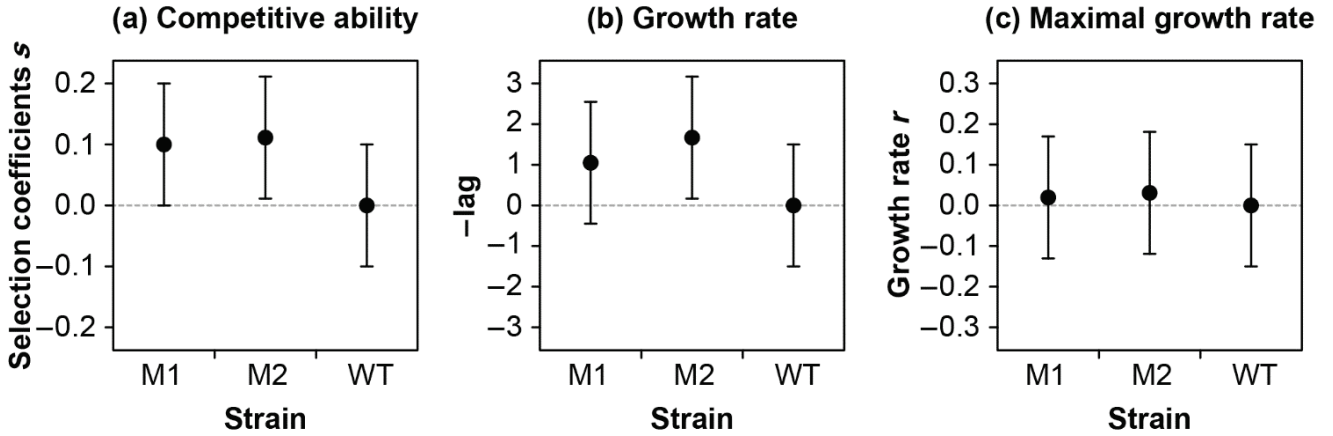
QUESTION 26 (4 marks)

Explain microevolutionary change through mutation.

QUESTION 27 (4 marks)

An experiment compared different strains of bacteria. A wild type (WT) of bacteria and two mutant strains, mutant 1 (M1) and mutant (M2), that had different disrupted genes were investigated. Maximal growth rate was used as a determinant of success rate.

The results of the experiment are shown below.

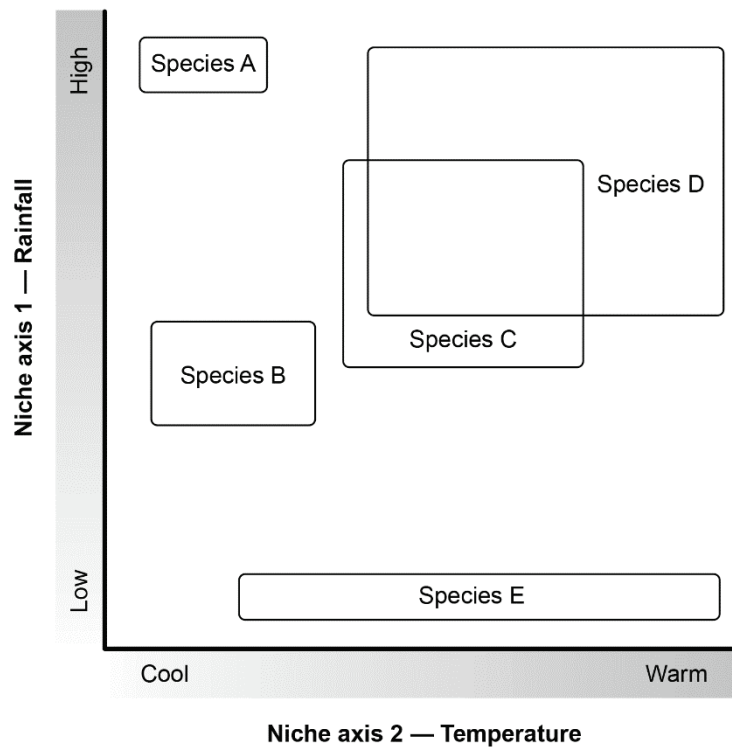


- a) Draw conclusions about the competitive ability and growth rate of the wild type of bacteria used in this experiment. [2 marks]

b) Appraise the outcome of the data and determine the success rate of the mutations for this species. [2 marks]

QUESTION 28 (5 marks)

The figure below shows a model of ecological niche occupation by species A–E.



a) Identify which two species are occupying the same ecological niche. [1 mark]

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- b) Species A and B have a common ancestor. Which diversification pattern would have occurred between species A and species B for them to occupy these niches? *[1 mark]*

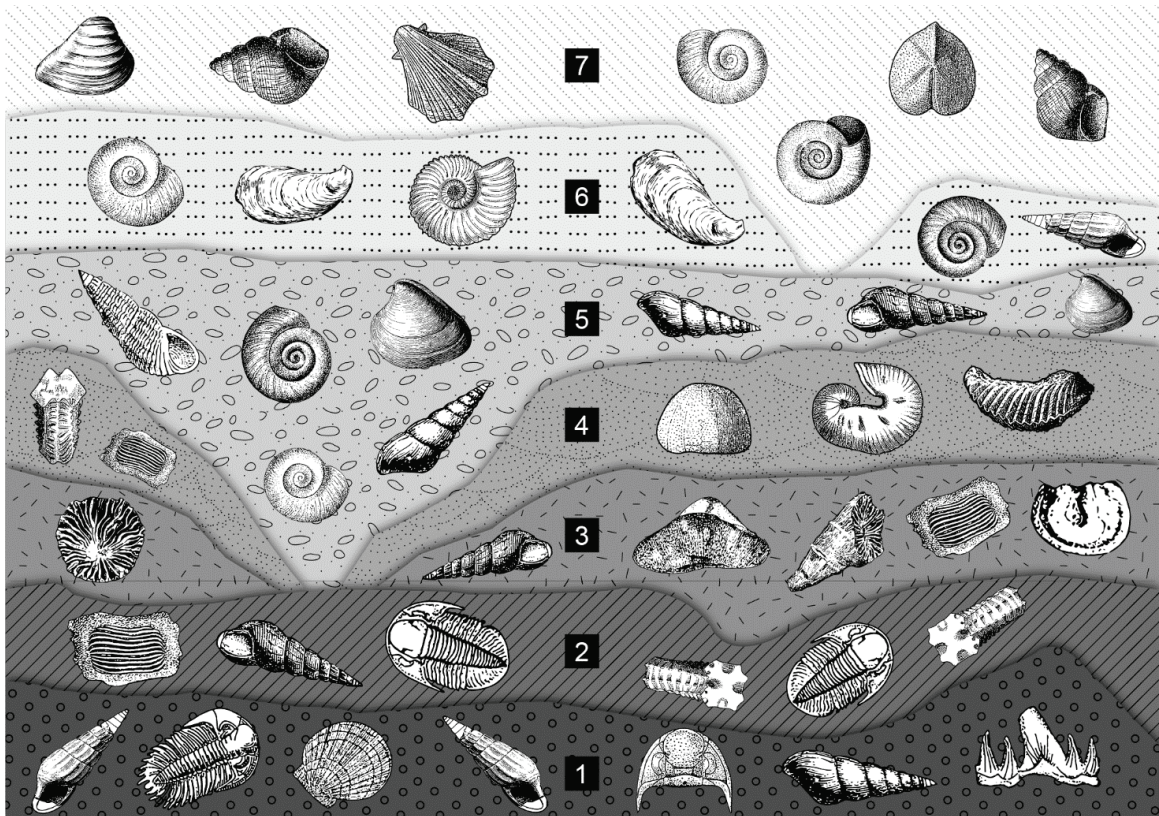
The table below shows the frequencies of genotypes and phenotypes for a particular trait in a generation of species E.

Genotype (% frequency)	Phenotype (% frequency)
TT (0)	Phenotype 1 (100)
Tt (100)	
tt (0)	Phenotype 2 (0)

- c) Predict the next generation's genotype and phenotype frequency. Which type of inheritance pattern is represented for Phenotype 1? *[3 marks]*

QUESTION 29 (6 marks)

The diagram below shows fossilised marine organisms found in a site across seven stratum layers.



- a) Analyse the data above to identify three relationships that provide evidence of changes in past ecosystems. Identify at least one biotic change and at least one abiotic change. [3 marks]

- b) From the given information, determine the species richness (D) for strata 2.
Use the following formula:

$$D = \frac{s}{\sqrt{N}}$$

Where s = the number of different species represented in the sample and N = the total number of individual organisms in the sample

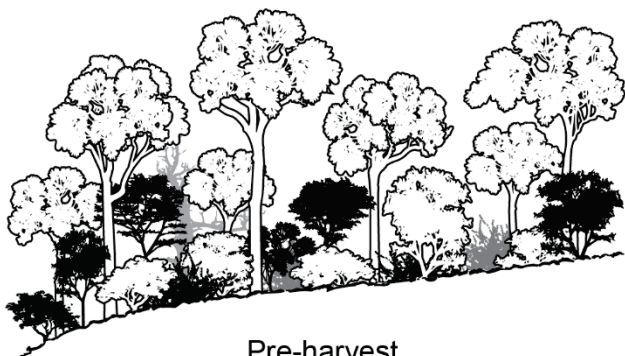
[2 marks]

- c) Identify one limitation of using fossil evidence to determine species richness.

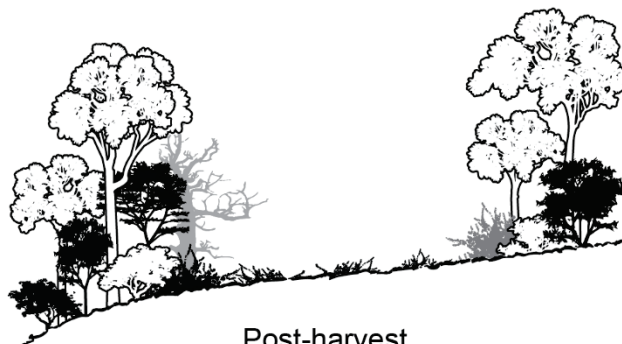
[1 mark]

QUESTION 30 (6 marks)

The figures below show a forest before harvesting (pre-harvest) and after harvesting (post-harvest).



Pre-harvest



Post-harvest

Identify an ecological surveying technique and sampling method that could be used to effectively analyse the change in species diversity between the two ecosystems. Identify a strength and a limitation of each of your choices.

END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

References

Question 27

Graphs derived from Vale, PF, Lafforgue, G, Gatchitch, F, Gardan, R, Moineau, S & Gandon, S 2015, 'Costs of CRISPR-Cas-mediated resistance in *Streptococcus thermophilus*', *Proceedings of the Royal Society B*, vol. 282, 'Figure 2' at p. 4, <https://doi.org/10.1098/rspb.2015.1270>.

Question 29

Diagram derived from:

- CK-12 Foundation 2009, *Earth Science* (flexbook), CK-12 Foundation, http://cafreetextbooks.ck12.org/science/CK12_Earth_Science_rev.pdf and
- White, CA 1883, *A Review of the Non-marine Fossil Mollusca of North America*, United States Government Printing Office, Washington, <https://doi.org/10.5962/bhl.title.58954>.

Question 30

Figures derived from Forestry Tasmania 2009, 'Group selection', *Native Forest Silviculture Technical Bulletin No. 8: Lowland wet eucalypt forests*, November, p. 8, www.sttas.com.au/sites/default/files/media/documents/tb8wet-eucalypts.pdf.

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Sample assessment 2020

Question and response book

Biology

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- Respond in paragraphs consisting of full sentences.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (45 marks)

- 11 short response questions



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Section 1

Instructions

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 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
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QUESTION 1 (1 mark)

Define the term gene.

QUESTION 2 (4 marks)

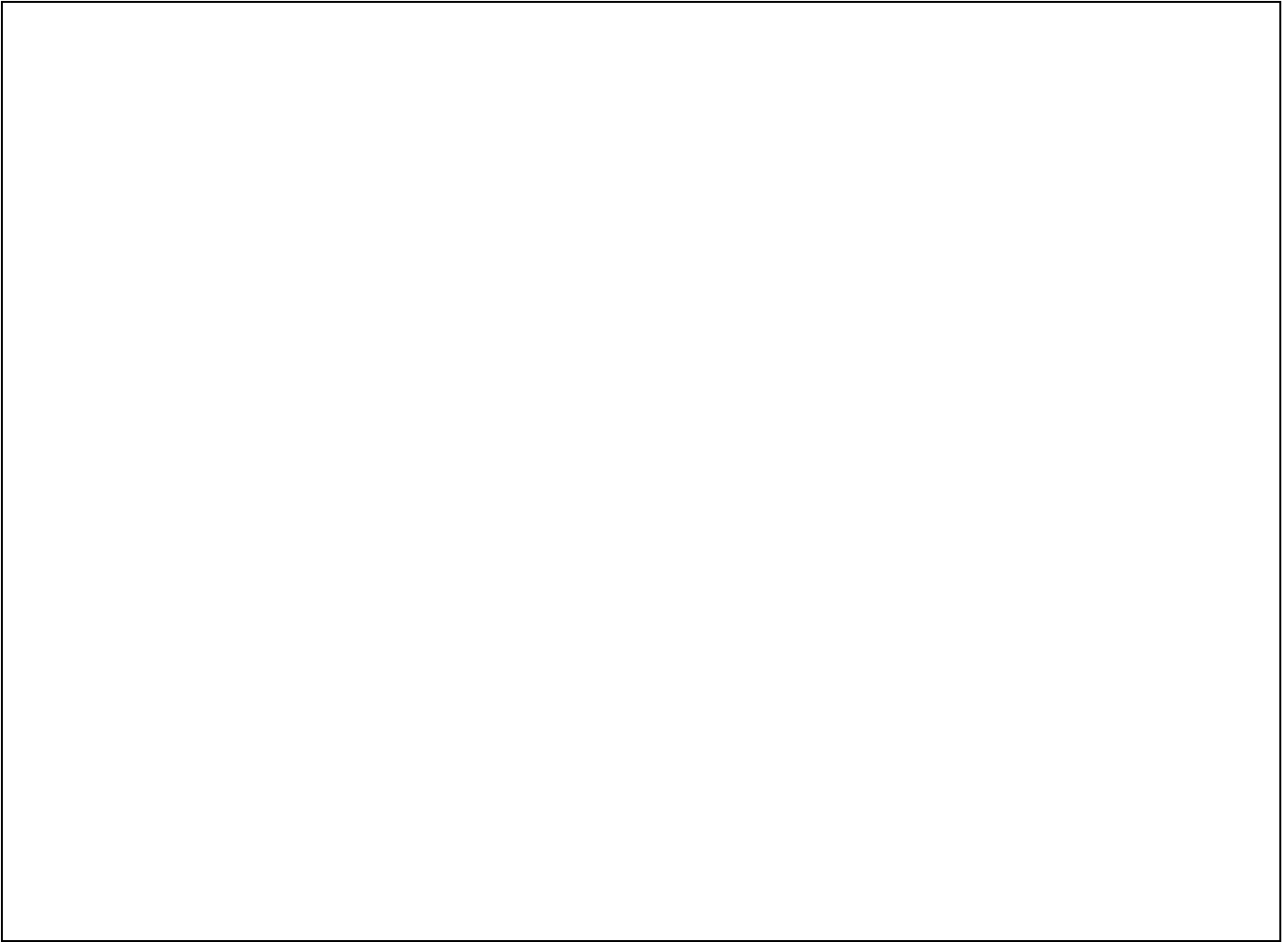
Explain how the process of classifying ecosystems is an important step toward effective ecosystem management of an old-growth forest.

QUESTION 3 (4 marks)

Explain two of the differences between DNA found in eukaryotes and prokaryotes.

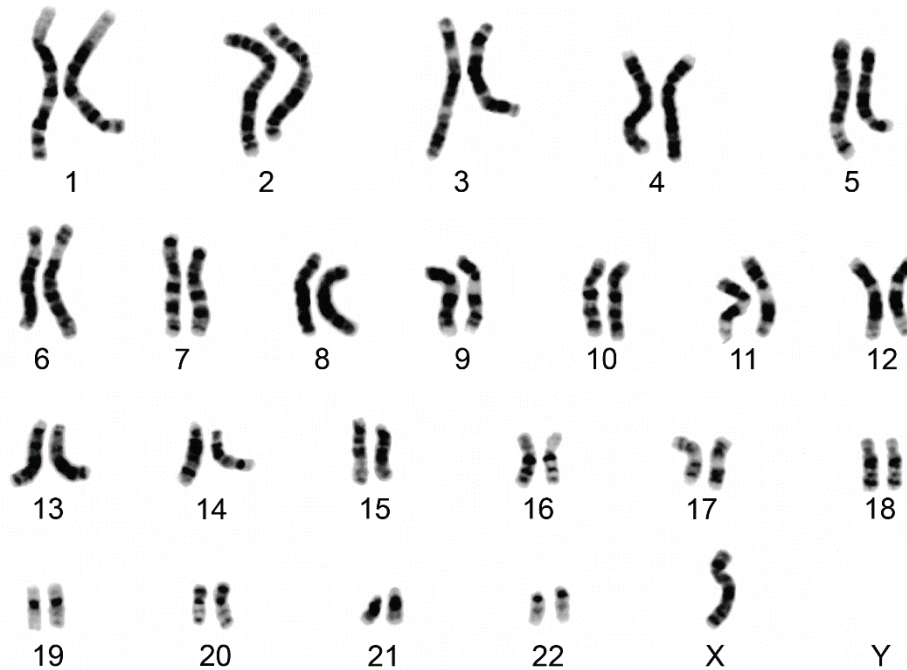
QUESTION 5 (4 marks)

Describe how the process of independent assortment during meiosis leads to variation in the genotype of offspring. A diagram may be used to demonstrate your response.



QUESTION 6 (2 marks)

The figure below is a human karyotype.



a) Identify the ploidy change.

[1 mark]

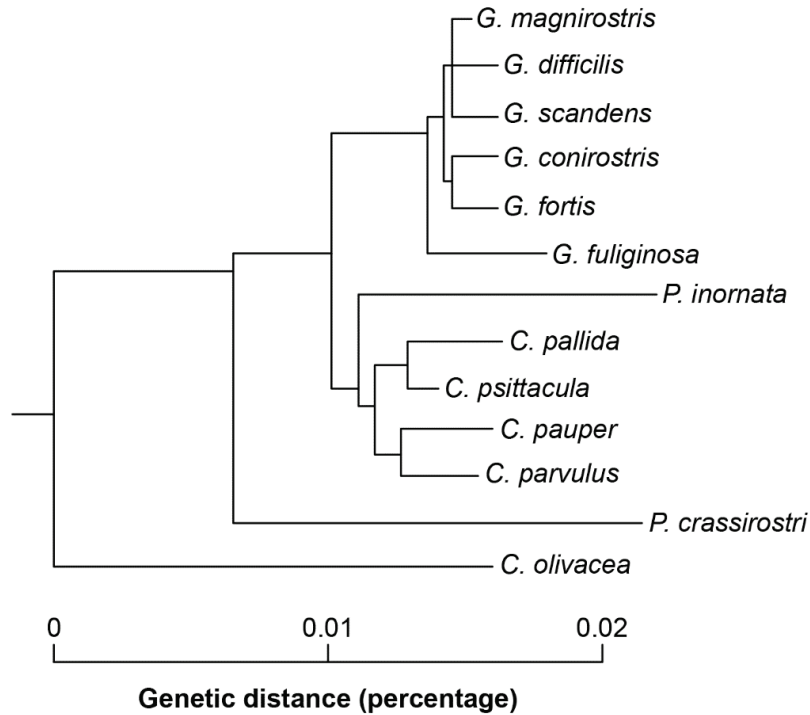
b) Using the table below, predict the genetic disorder that is likely to occur due to this ploidy change.

[1 mark]

Chromosome number	Monosomy	Trisomy
11	Jacobsen syndrome	
13		Patau syndrome
18		Edwards syndrome
23	Turner syndrome	

QUESTION 7 (6 marks)

The figure below is a cladogram of Darwin's finches.



a) What is one of the common assumptions of cladistics? [1 mark]

b) Infer which species is genetically closest to the common ancestor for the finches shown. Give a reason to support your answer. [2 marks]

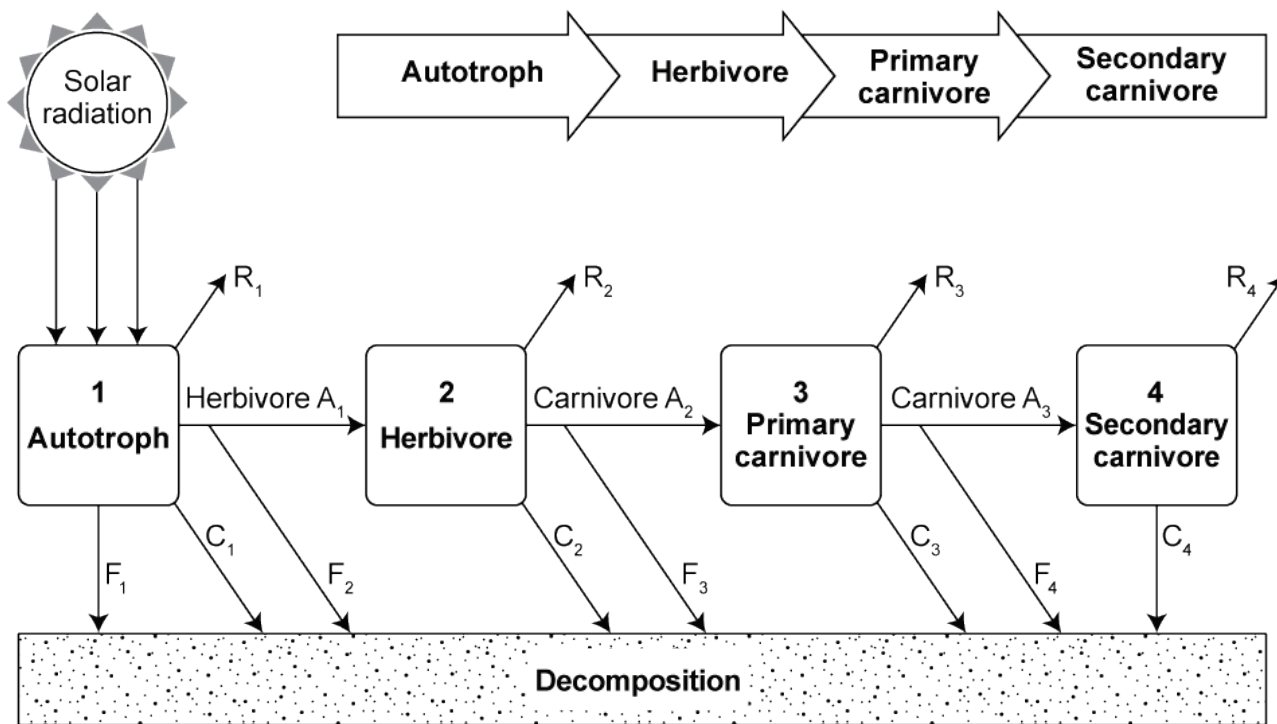
c) Interpret the cladogram to infer the degree of DNA similarity of all of the species shown. [1 mark]

d) Identify two other types of evidence that could be used to determine the relatedness of these organisms.

[2 marks]

QUESTION 8 (5 marks)

The figure below is a diagrammatic representation of a grazing food chain showing inputs and losses of energy at each trophic level.



a) Identify what types of energy transfers are represented by the letters A and F in this figure.

[2 marks]

A: _____

F: _____

b) Explain the following processes:

[2 marks]

- Energy transformation from solar radiation to autotrophs

- Energy transfer from autotrophs to herbivores

c) Contrast the efficiency of the processes explained in 8b) with subsequent trophic energy transfers.

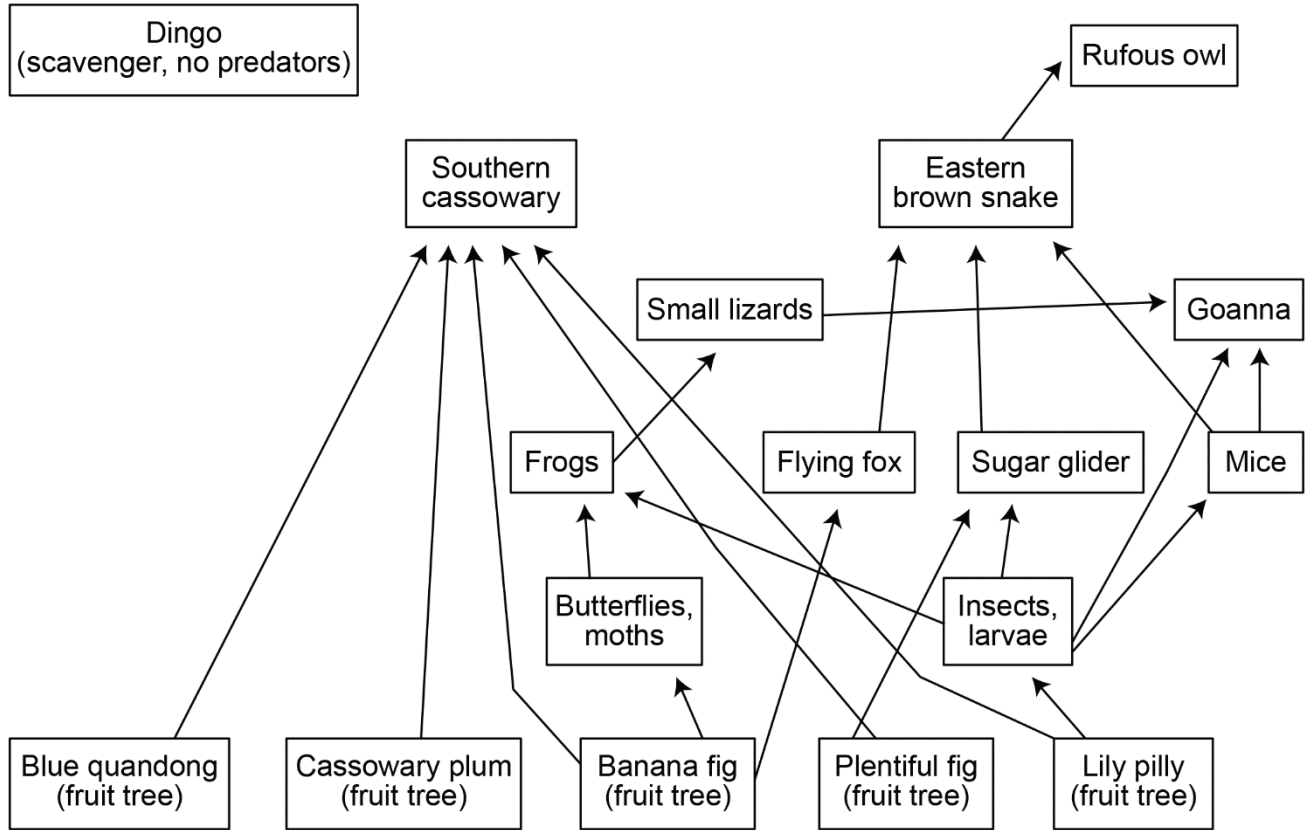
[1 mark]

QUESTION 9 (3 marks)

Explain the concept of ecological succession in a climax ecosystem exposed to a bushfire.

QUESTION 10 (6 marks)

The diagram below is a food web of biota in an Australian rainforest.



a) Analyse the given information to identify the keystone species. [1 mark]

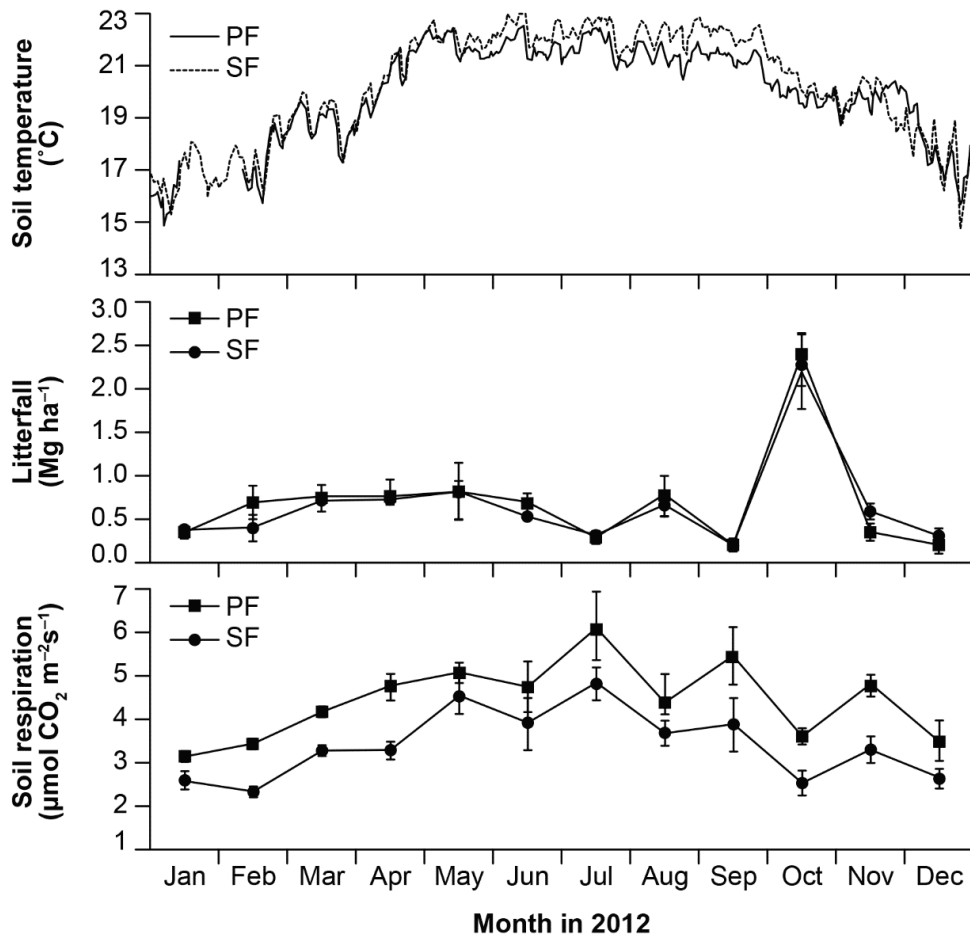
b) Predict the outcome for the ecosystem of removing the keystone species. Give a reason. [2 marks]

c) If this rainforest habitat was to become fragmented, identify which mechanism of isolation would most likely influence the gene flow of species. Give two reasons to support your response.

[3 marks]

QUESTION 11 (6 marks)

The graphs below show the seasonal patterns of soil temperature (at 10 cm depth), litterfall and total soil respiration in a primary forest (PF) and secondary forest (SF).



a) Compare the ecosystems across a temporal scale using the given data.

[4 marks]

b) Identify an effect of increasing the availability of nutrients on the carrying capacity of this primary forest ecosystem. Give a reason to support your answer.

[2 marks]

END OF PAPER

References

Question 6

Figure derived from National Cancer Institute 1997, *Karotype (Normal)*,
<https://visualsonline.cancer.gov/details.cfm?imageid=2721>.

Question 7

Figure derived from White, R 2011, *Darwiniana and Evolution: Picturing evolutionary trees*,
www.darwiniana.org/trees.htm.

Question 11

Graphs derived from Zhou, Z, Jiang, L, Du, E, Hu, H, Li, Y, Chen, D & Fang, J 2013, 'Temperature and substrate availability regulate soil respiration in the tropical mountain rainforests, Hainan Island, China', *Journal of Plant Ecology*, vol. 6, no. 5, pp 325–334, <https://doi.org/10.1093/jpe/rtt034>.

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Mock assessment 2020

Multiple choice question book

Biology

Paper 1



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Section 1

Instructions

- Answer all questions in the question and response book.
 - This book will not be marked.
-

QUESTION 1

During meiosis, the processes of crossing over and recombination occur within

- (A) anaphase I.
- (B) telophase I.
- (C) prophase I.
- (D) metaphase I.

QUESTION 2

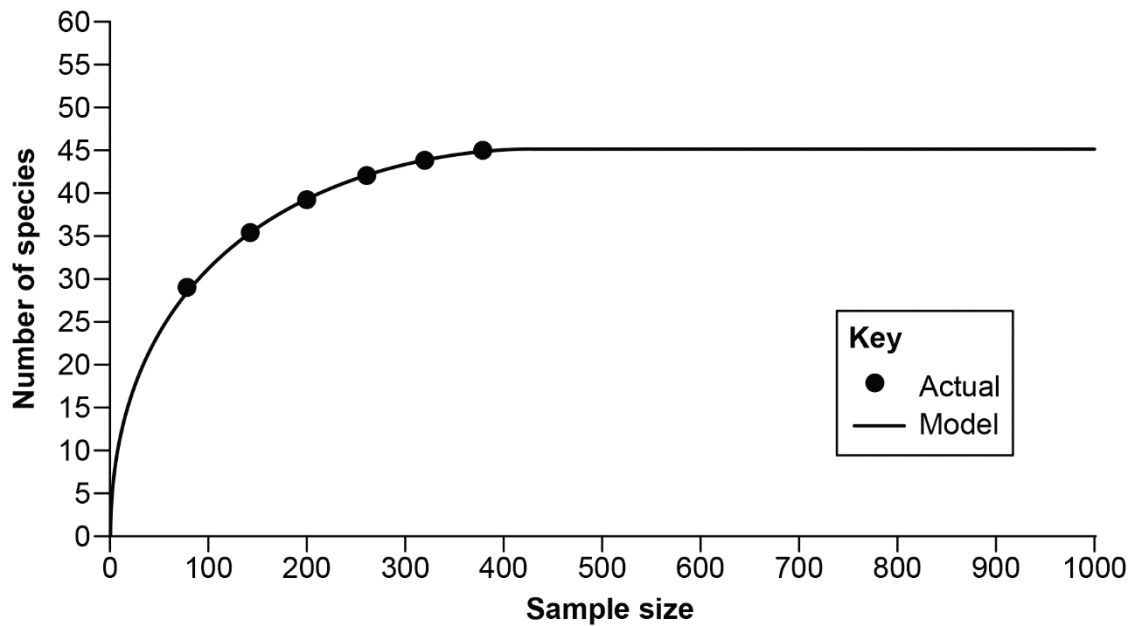
Allopatric speciation can be described as

- (A) two subpopulations of a species becoming isolated from each other, which prevents genetic exchange.
- (B) two subpopulations of a species evolving in reproductive isolation while continuing genetic exchange.
- (C) new species evolving from a single ancestral species while inhabiting the same geographic region.
- (D) new species forming from an isolated peripheral population.

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QUESTION 3

The species accumulation curve below estimates species richness for one study site.



Determine the estimated species richness for this study site.

- (A) 25
- (B) 35
- (C) 40
- (D) 45

QUESTION 4

Protein synthesis is the process of

- (A) duplicating DNA.
- (B) forming amino acids directly from DNA.
- (C) synthesising mRNA from a DNA template.
- (D) synthesising a chain of amino acids from mRNA.

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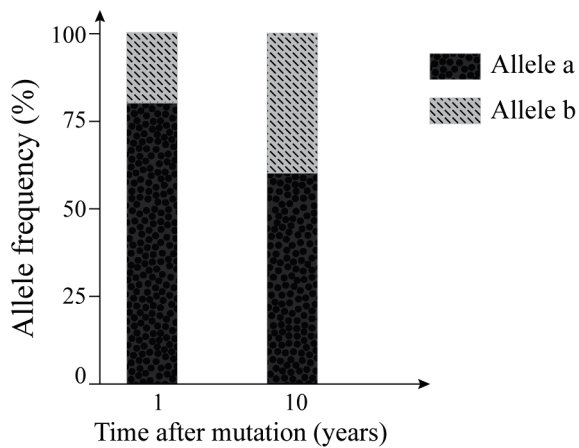
QUESTION 5

Within the nitrogen cycle, the transformation of nitrates into nitrogen gas is called

- (A) nitrification.
- (B) denitrification.
- (C) ammonification.
- (D) nitrogen fixation.

QUESTION 6

The graph shows allele frequency changes in a gene pool of fish (guppies) over a 10 year period after a mutation event which gave rise to allele b.



The frequency changes for allele b can be explained by which process?

- (A) positive selection
- (B) negative selection
- (C) stabilising selection
- (D) disruptive selection

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QUESTION 7

During oogenesis in a human, sister chromatids of the X chromosome fail to separate, resulting in the ovum containing two X chromosomes. After the ovum is fertilised by a sperm with a normal chromosome number, which of the following would represent the somatic number of the zygote formed?

- (A) $2n+1$
- (B) $2n$
- (C) $2n-1$
- (D) $2n-2$

QUESTION 8

Which of the following processes would result in aneuploidy?

- (A) The exchange of genetic material that occurs during crossing over.
- (B) The failure of a homologous pair to separate during meiosis I.
- (C) The failure of chromosomes to correctly align at prophase II.
- (D) The separation of homologous pairs during metaphase.

QUESTION 9

A clade is a group of organisms

- (A) of one or more populations that form a unit.
- (B) living in a particular geographical area that can interbreed.
- (C) that consists of a common ancestor and all its lineal descendants.
- (D) consisting of similar individuals capable of exchanging genes or interbreeding.

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QUESTION 10

Biodiversity is recognised as the total variety of

- (A) species interrelationships, biotic and abiotic factors.
- (B) communities of organisms occupying major habitats.
- (C) regions of surface and atmosphere occupied by organisms.
- (D) organisms, habitats, communities and ecological processes.

QUESTION 11

The non-coding regions at the end of chromosomes that provide protection during DNA replication are

- (A) centromeres.
- (B) telomeres.
- (C) introns.
- (D) tRNA.

QUESTION 12

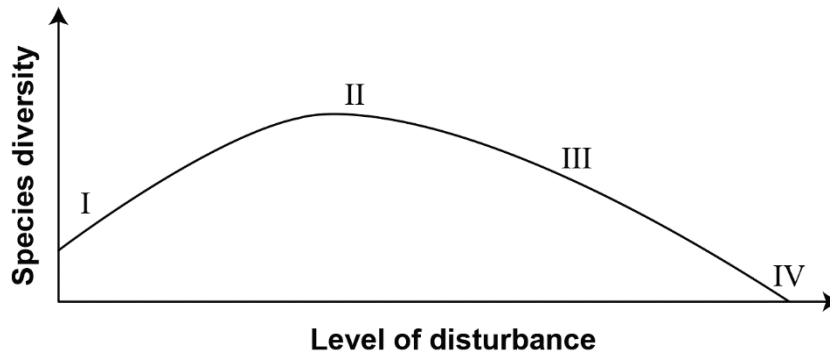
Microevolution is the small-scale variation of allele frequencies

- (A) within a population in which the descendant is of the same taxonomic group as the ancestor.
- (B) that causes a change in the genetic composition of a population during successive generations.
- (C) that increases taxonomic diversity or morphological disparity, due to adaptive changes in species.
- (D) above the level of species, in which the descendant is in a different taxonomic group to the ancestor.

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QUESTION 13

The diagram below shows the influence of increasing levels of ecological disturbance (e.g. from rare to widespread logging of a forest) on species diversity in an ecosystem.



Which option corresponds to a level of ecological disturbance that could result in decreased species diversity due to competitive exclusion?

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

QUESTION 14

A purpose of using gel electrophoresis is to

- (A) compare DNA banding patterns.
- (B) eliminate undesirable traits in genes.
- (C) control gene expression in organisms.
- (D) generate copies of single-stranded DNA.

QUESTION 15

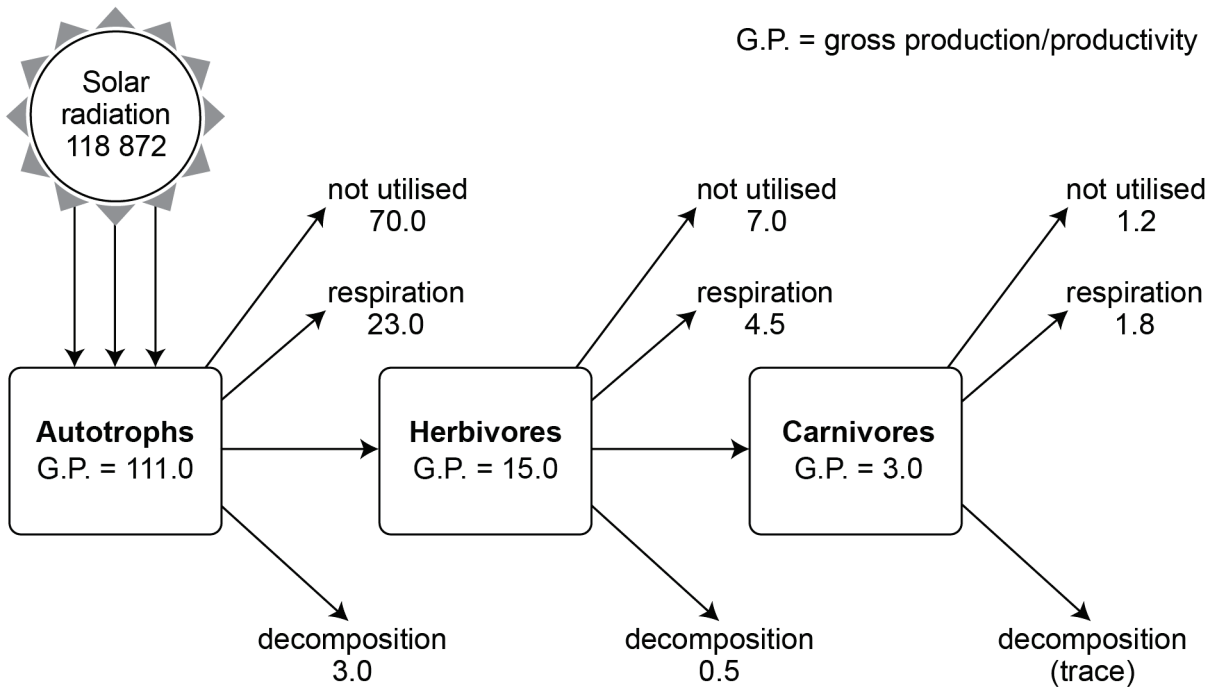
Multiple definitions of species are required because some species definitions cannot be applied to

- (A) viruses, sexual and clonal organisms.
- (B) viruses, clonal and asexual organisms.
- (C) bacteria, non-clonal and sexual organisms.
- (D) bacteria, non-clonal and asexual organisms.

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QUESTION 16

The figure below shows an energy diagram for a freshwater lake ecosystem.



The percentage of energy transferred to herbivores is

- (A) 86.5%.
- (B) 20.0%.
- (C) 13.5%.
- (D) 0.01%.

QUESTION 17

Two organisms live in close physical association, typically to the advantage of both.

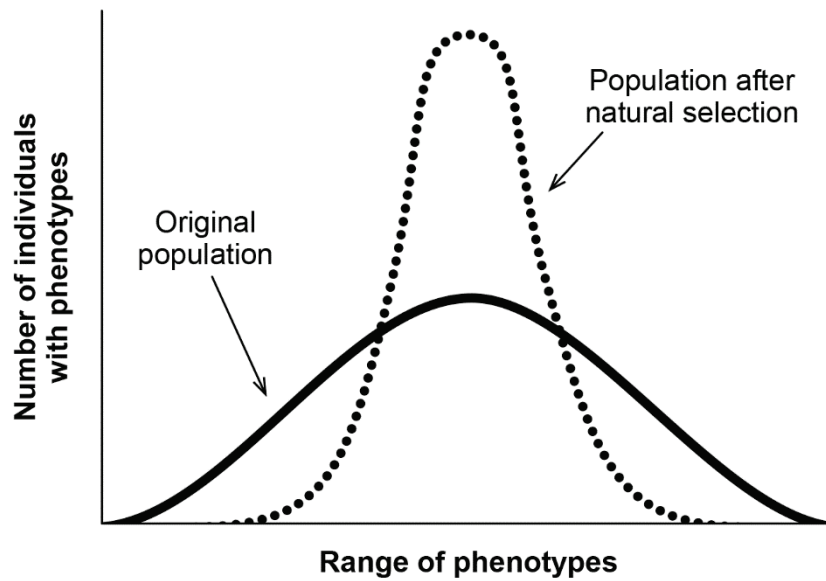
Which of the following is the correct species interaction to describe this relationship?

- (A) competition
- (B) symbiosis
- (C) predation
- (D) disease

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QUESTION 18

The figure below shows the range of phenotypes in a population before and after natural selection.



Which type of phenotypic selection is shown in the figure?

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

QUESTION 19

The black-browed albatross is a wide-ranging, large seabird that forages far offshore and returns to communal breeding sites.

Which limiting factor is likely to have the greatest negative impact on the carrying capacity of this species?

- (A) food supply
- (B) mate availability
- (C) natural predation
- (D) presence of parasites

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QUESTION 20

An ecological niche is defined as the role and space that an organism fills in an ecosystem, including all its interactions with the

- (A) biotic and abiotic factors of its environment.
- (B) available resources and services of its environment.
- (C) other species in its environment that it outcompetes.
- (D) individuals immigrating and emigrating in its environment.

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References

Question 3

Figure derived from Terrestrial Ecosystems 2013, 'Species accumulation curves', *Terrestrial Ecosystems*, <https://terrestrialecosystems.com/species-accumulation-curves>.

Question 13

Figure adapted from Sciencerelatedusername 2016, 'Intermediate disturbance hypothesis graph', *Wikimedia Commons*, https://en.wikipedia.org/wiki/File:Intermediate_Disturbance_Hypothesis_Graph.svg#/media/File:Intermediate_Disturbance_Hypothesis_Graph.svg, licensed under CC BY-SA 4.0, <https://creativecommons.org/licenses/by-sa/4.0>.

Question 16

Figure derived from Your Article Library (n.d.), '2 models of flow of energy in an ecosystem (with diagram) — explained!', *Your Article Library*, www.yourarticlelibrary.com/environment/ecosystem/2-models-of-flow-of-energy-in-an-ecosystem-with-diagram-explained/27324.

Question 18

Figure adapted from Ealbert17 2015, 'Genetic distribution', *Wikimedia Commons*, https://commons.wikimedia.org/wiki/File:Genetic_Distribution.svg, licensed under CC BY-SA 4.0, <https://creativecommons.org/licenses/by-sa/4.0>.

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Mock assessment 2020

Question and response book

Biology

Paper 1

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (20 marks)

- 20 multiple choice questions

Section 2 (30 marks)

- 9 short response questions



Section 1

Instructions

- Choose the best answer for Questions 1–20.
- This section has 20 questions and is worth 20 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	A	B	C	D
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 2

Instructions

- Write using black or blue pen.
- Respond in paragraphs consisting of full sentences.
- If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
- This section has nine questions and is worth 30 marks.

QUESTION 21 (2 marks)

The table below shows mark and recapture data for a bird species.

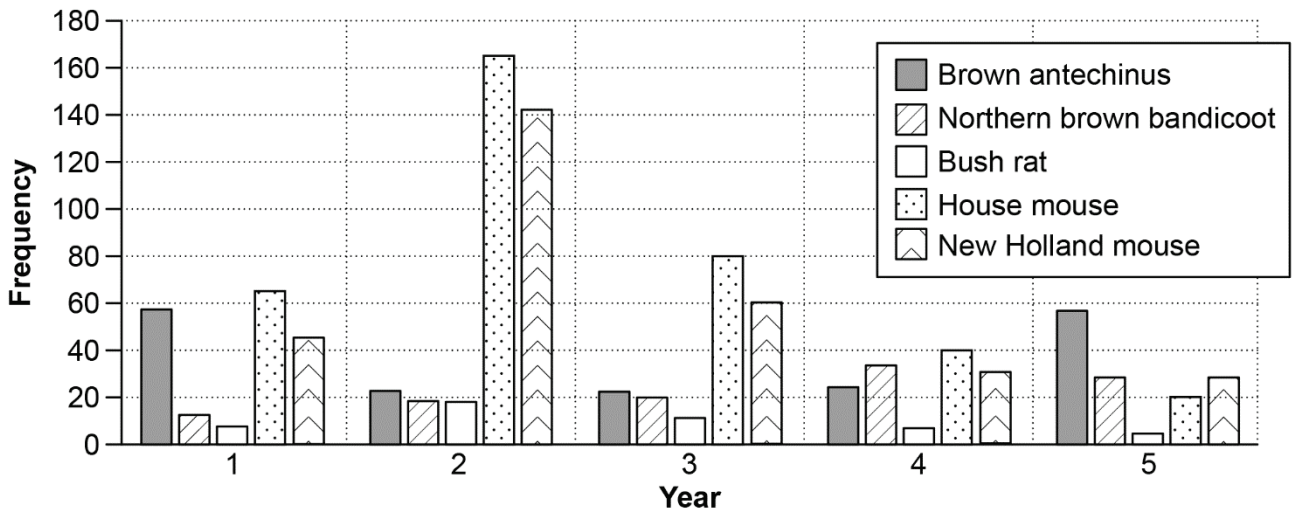
Species	First capture	Second capture	
	Total number of individuals	Total number of individuals	Total number of tagged individuals
<i>Alisterus scapularis</i>	26	50	10

Use the Lincoln Index ($N = \frac{M \times n}{m}$) to calculate the estimated population size of *Alisterus scapularis*. Show your working.

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QUESTION 22 (5 marks)

An Australian coastal heathland was monitored before a bushfire occurred. The population of small mammals was studied for five years following the bushfire. The results are shown below.



a) Draw three conclusions about the successional relationships in this ecosystem. [3 marks]

1. _____

2. _____

3. _____

b) Predict which mammal will be the most abundant in the sixth year after the bushfire. Give a reason. [2 marks]

QUESTION 23 (2 marks)

Some species have a small home range but individuals may use a diverse variety of microhabitats within an ecosystem.

Identify two reasons why it is important for ecologists to understand that ecosystems are composed of varied habitats.

1. _____

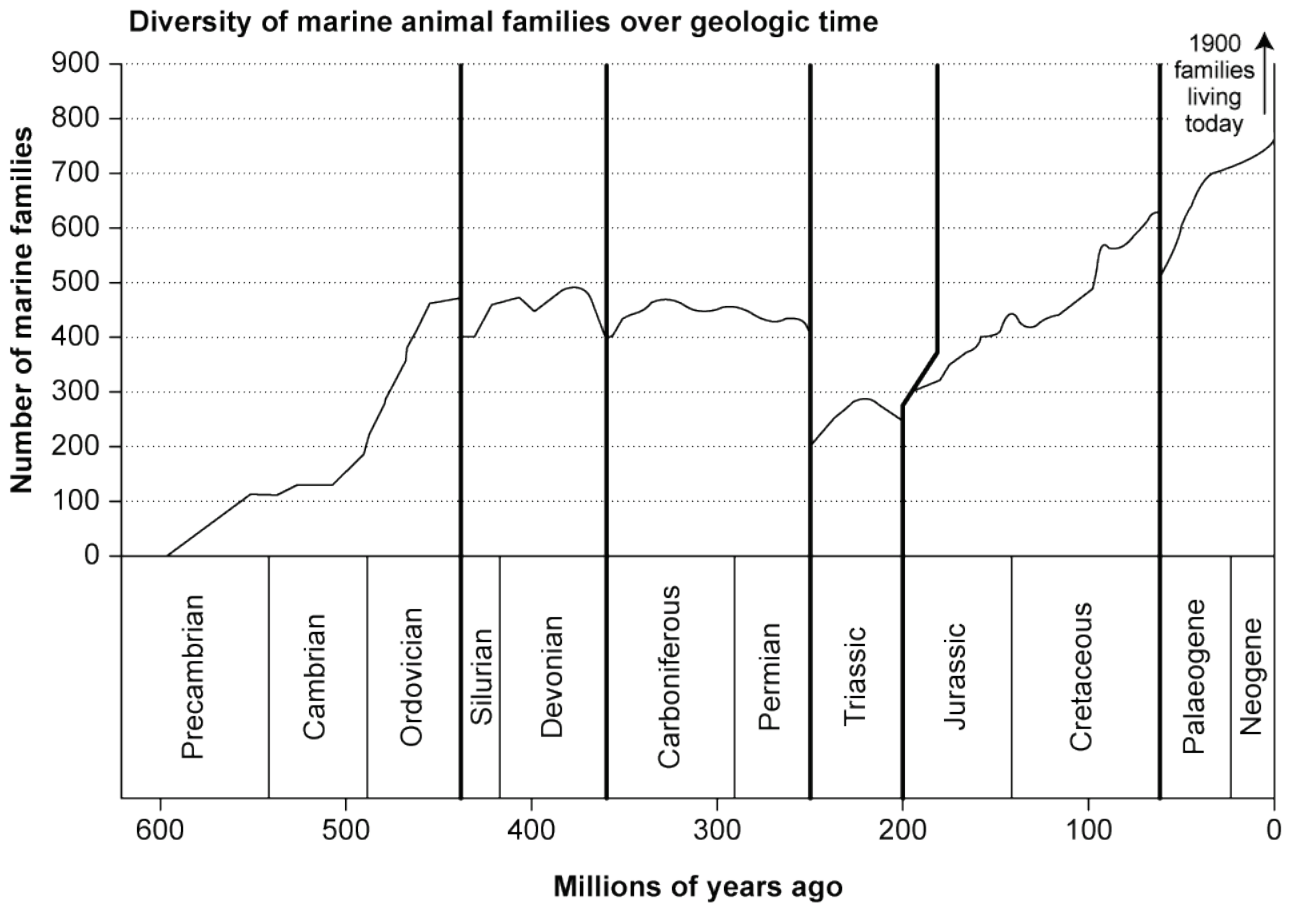
2. _____

QUESTION 24 (2 marks)

Explain how damage caused by ultraviolet (UV) radiation can cause mutations in DNA.

QUESTION 25 (2 marks)

The figure below shows the diversity of marine animals since the late Precambrian time. The data is from marine animal families that have been reliably preserved in the fossil record.



Identify a geological period of evolutionary radiation and geological period of mass extinction.

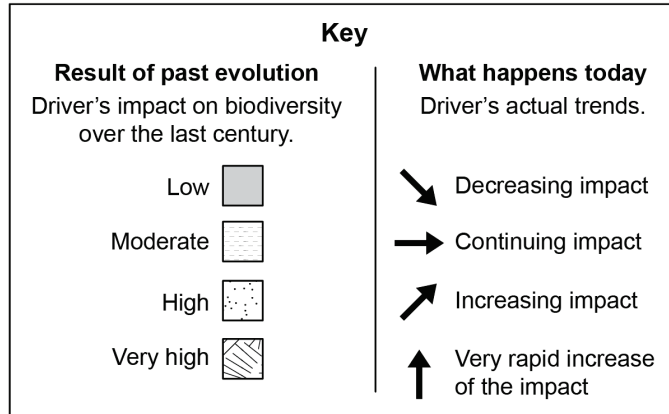
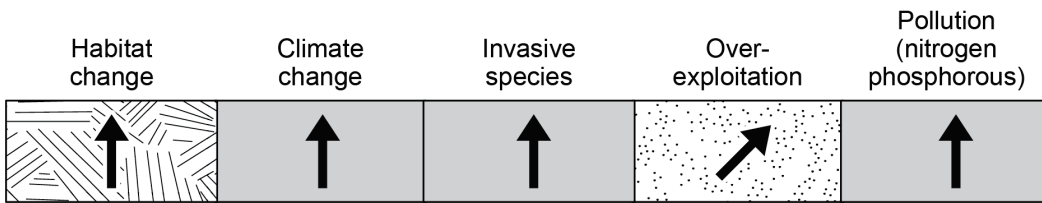
Evolutionary radiation: _____

Mass extinction: _____

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QUESTION 26 (4 marks)

The information below shows the relative magnitudes of changes to global tropical rainforests caused by changes in drivers.



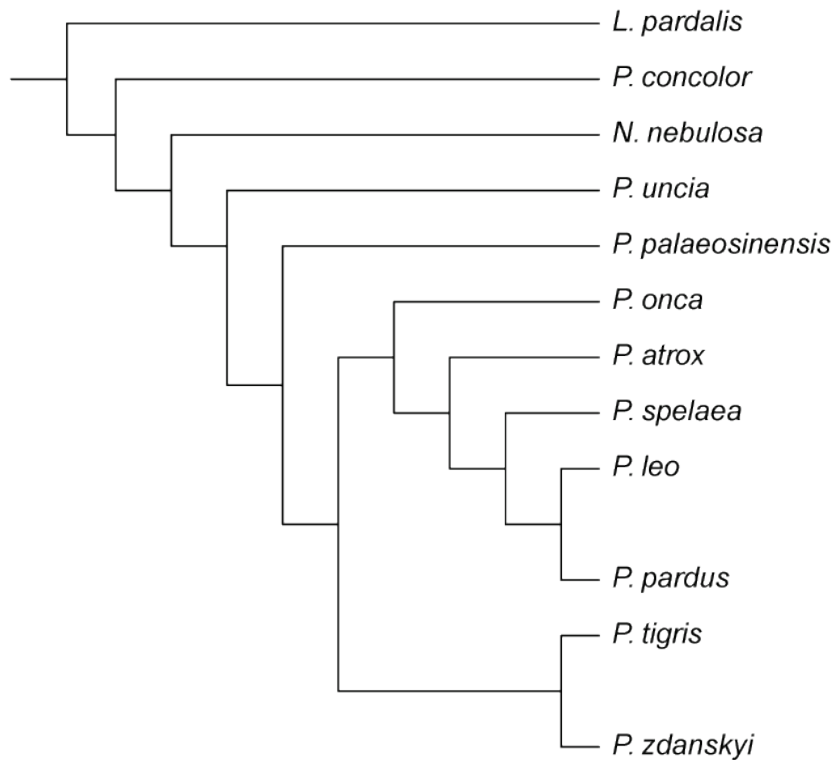
Predict the two drivers that will have the greatest magnitude of change, and their direct impacts, for future biodiversity in global tropical rainforests.

1. _____

2. _____

QUESTION 27 (2 marks)

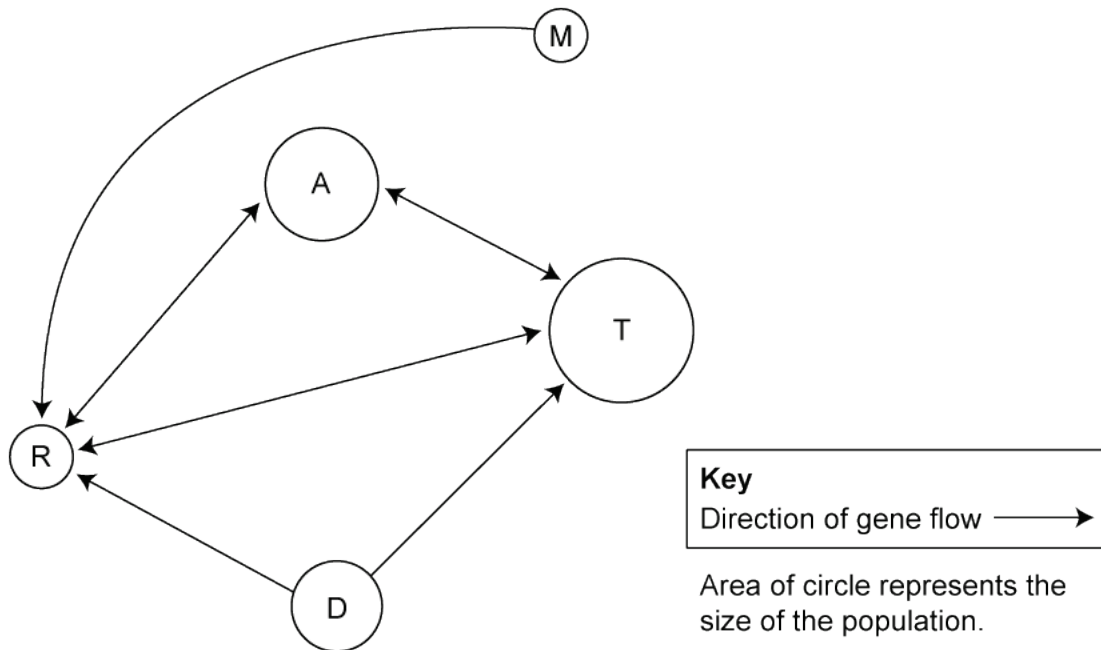
The phylogenetic tree below is based on comparative molecular data and models possible relationships between various large cats. The lengths of the horizontal lines indicate the periods of genetic change since the cats branched from their common ancestors.



Identify which species, *N. nebulosa* or *P. pardus*, is more closely related to *P. tigris*. Justify your answer.

QUESTION 28 (7 marks)

The figure below shows the gene flow between five different populations of a hypothetical species.



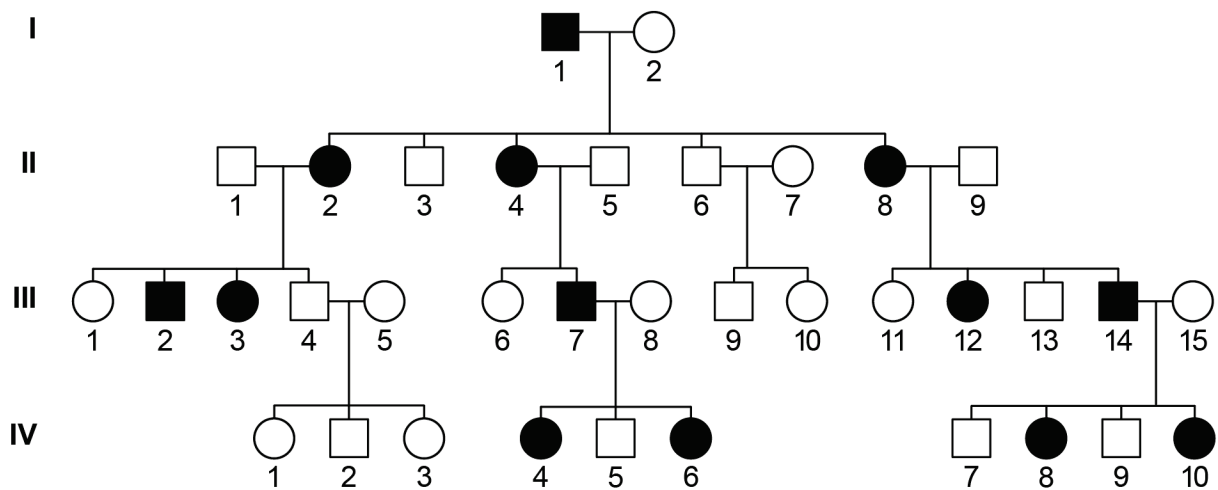
An event occurs that causes R to become geographically isolated.

- a) Identify which population/s are most likely to form new species. Justify your answer. *[4 marks]*

b) Identify which population would gain a selective advantage if an environmental selective pressure that favours phenotypic diversity is applied to this situation. Justify your answer. [3 marks]

QUESTION 29 (4 marks)

The inheritance of Fragile X syndrome is X-linked dominant. The pedigree below shows the occurrence of the syndrome in one family with individual IV-4 being heterozygous for Fragile X syndrome. Affected individuals are shaded.



Predict the probability of an offspring being male with the disorder if individual IV-4 mates with an individual without the syndrome. Show your reasoning.

END OF PAPER

References

Question 22

Figure derived from Fox, BJ 1982, 'Fire and mammalian secondary succession in an Australian coastal heath', *Ecology*, vol. 63, no. 5, pp. 1332–1341, <https://doi.org/10.2307/1938861>.

Question 25

Figure derived from Encyclopaedia Britannica Inc. 2018, 'Mass extinction event', *Encyclopaedia Britannica*, <https://www.britannica.com/science/mass-extinction-event>.

Question 26

Figure derived from Millennium Ecosystem Assessment 2005, *Ecosystems and Human Well-being: Biodiversity synthesis*, World Resources Institute, Washington, DC, www.researchgate.net/publication/269576188_Ecosystems_and_Human_Well-Being_Biodiversity_Synthesis.

Question 27

Figure derived from Mazák, JH, Christiansen, P & Kitchener, A 2011, 'Oldest known Pantherine skull and evolution of the tiger', *PLoS ONE*, vol. 6, no. 10, <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0025483>.

Question 28

Figure derived from Matsunami, M, Igawa, T, Michimae, H, Miura, T & Nishimura, K 2016, 'Population structure and evolution after speciation of the Hokkaido salamander (*Hynobius retardatus*)', *PLOS One*, vol. 11, no. 6, <https://doi.org/10.1371/journal.pone.0156815>.

Question 29

Figure derived from Caulton, S 2013, 'File:Sex linked inheritance.png', *Wikipedia Commons*, https://commons.wikimedia.org/w/index.php?title=File:Sex_linked_inheritance.png&oldid=219628926.

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Mock assessment 2020

Question and response book

Biology

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- Respond in paragraphs consisting of full sentences.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (43 marks)

- 11 short response questions



Section 1

Instructions

- Write using black or blue pen.
 - Respond in paragraphs consisting of full sentences.
 - If you need more space for a response, use the additional pages at the back of this book.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
-

QUESTION 1 (3 marks)

Describe the process of parapatric speciation.

QUESTION 2 (4 marks)

Describe four features of the Linnaean system of classification.

1. _____

2. _____

3. _____

4. _____

QUESTION 3 (2 marks)

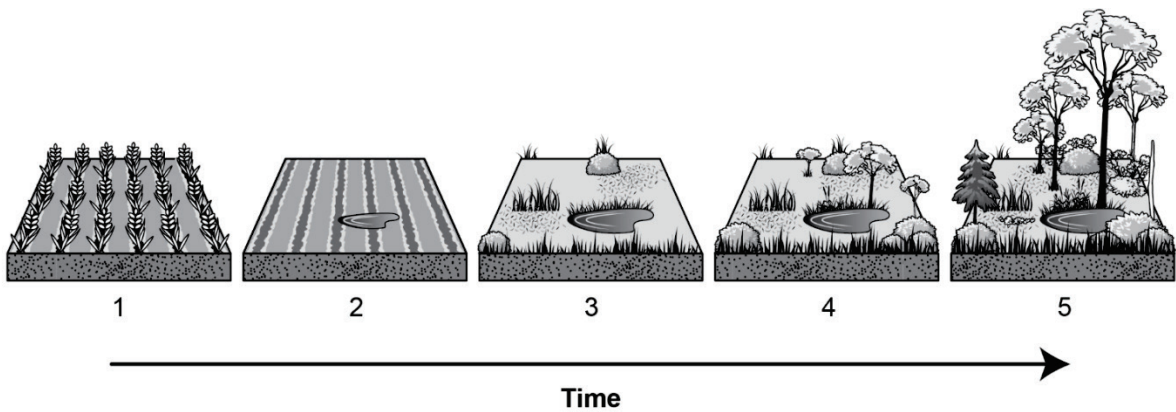
Identify two roles that keystone species play in maintaining the structure of a community.

1. _____

2. _____

QUESTION 4 (4 marks)

The figure shows the succession for a hypothetical ecosystem.

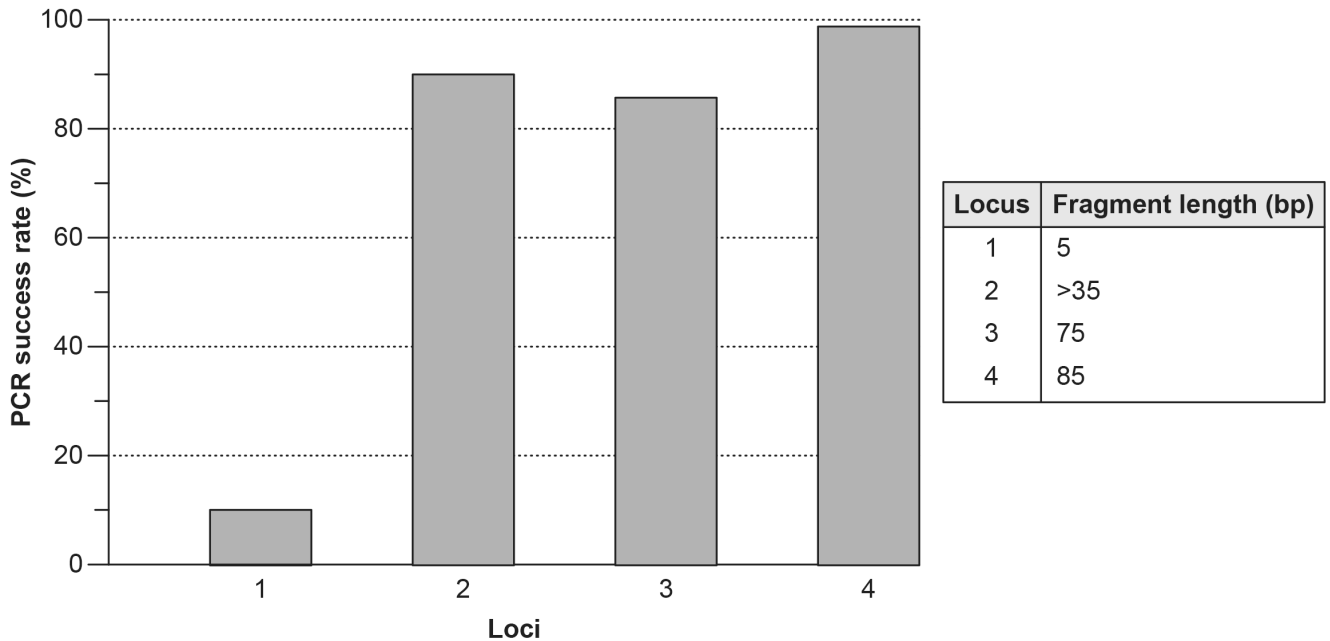


Identify which type of succession has occurred. Give three reasons to support your response.

QUESTION 7 (2 marks)

An experiment was conducted on four specific chromosome regions (loci) used in the identification of medicinal plants.

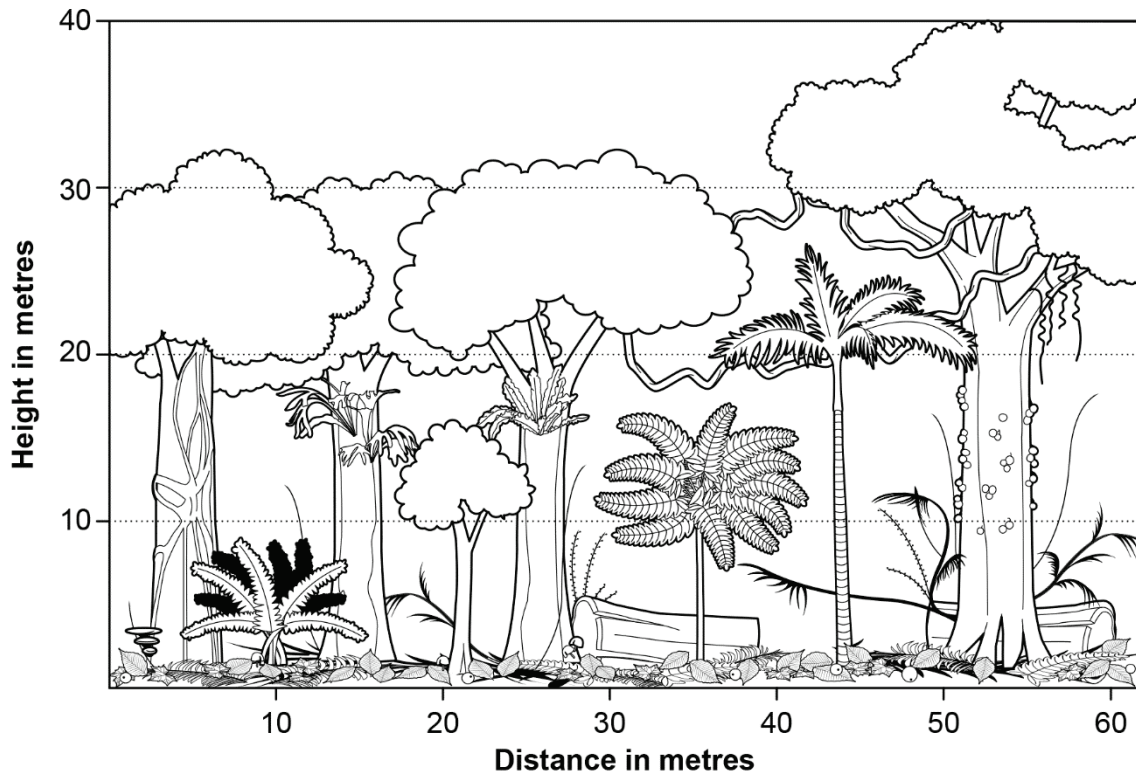
The graph shows the success rates for polymerase chain reaction (PCR) amplification of the four loci. The table shows the fragment length (in base pairs) obtained for each locus.



Draw a conclusion about the outcome of PCR amplification in terms of success rate and fragment length.

QUESTION 8 (6 marks)

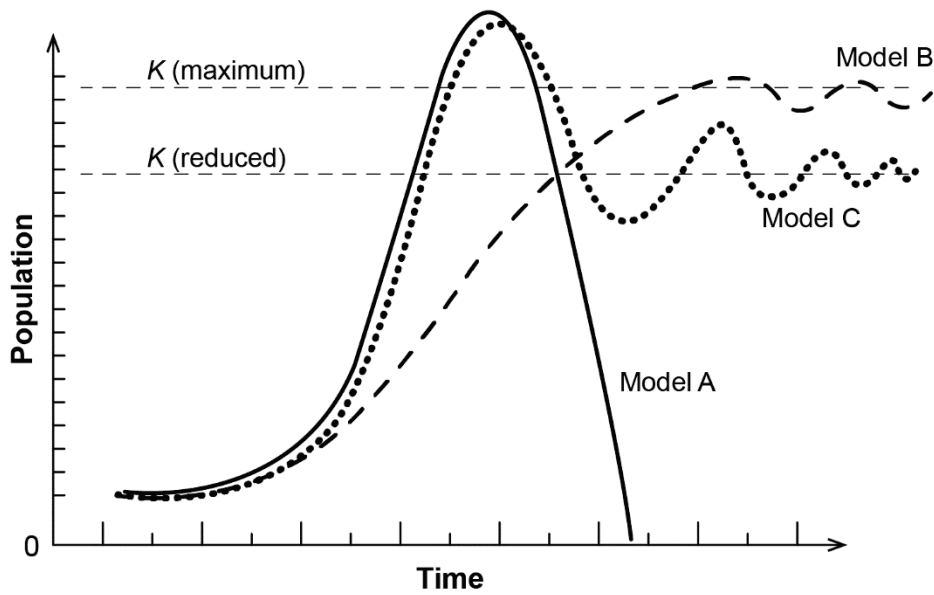
A field investigation was conducted on site in a rainforest. The figure shows a diagrammatic representation of the plant species recorded.



Describe the process of applying stratified sampling to assess this site.

QUESTION 10 (4 marks)

The figure below depicts the changes in three models of a population in relation to the maximum carrying capacity, K (maximum), of an ecosystem and the reduced carrying capacity, K (reduced).



- a) Identify one model that is affected by a density-dependent factor, giving a reason. [2 marks]

- b) Identify two factors that might have caused the decrease in population in Model C before it stabilised at a reduced carrying capacity. [2 marks]

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

References

Question 7

Graph derived from Yu, N, Gu, H, Wei, Y, Zhu, N, Wang, Y, Zhang, H, Zhu, Y, Zhang, X, Ma, C & Sun, A 2016, 'Suitable DNA barcoding for identification and supervision of *Piper kadsura* in Chinese medicine markets', *Molecules*, vol. 21, no. 9, <https://doi.org/10.3390/molecules21091221>.

Question 8

Figure inspired by Lowman, MD 1995, 'Herbivory in Australian forest — a comparison of dry sclerophyll and rain forest canopies', *Proceedings of the Linnean Society of New South Wales*, vol. 115, pp. 77–87, <https://canopymeg.com/PDFs/papers/0049.pdf>.

Question 10

Figure inspired by Barrett, GW & Odum, EP 2000, 'The twenty-first century: The world at carrying capacity', *BioScience*, vol. 50, no. 4, pp. 363–368, [https://doi.org/10.1641/0006-3568\(2000\)050\[0363:TTFCTW\]2.3.CO;2](https://doi.org/10.1641/0006-3568(2000)050[0363:TTFCTW]2.3.CO;2).

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