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Sample 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

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.

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%

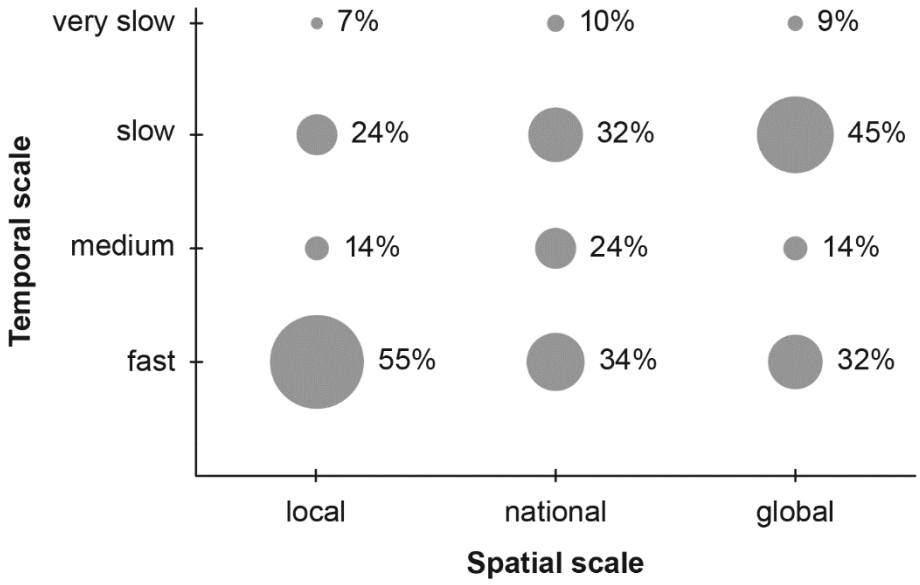
(B) –44%

(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

QUESTION 9

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

(A) gene therapy

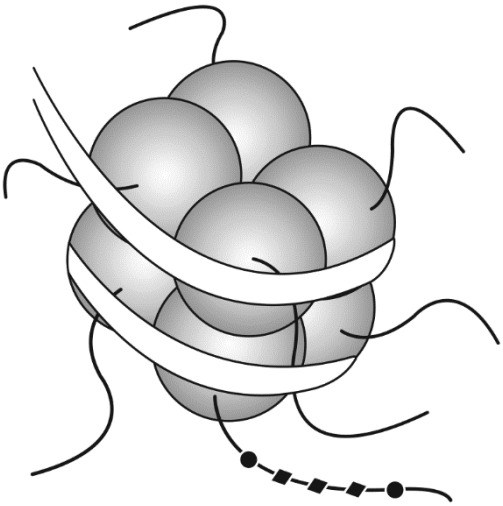
(B) food security

(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.

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

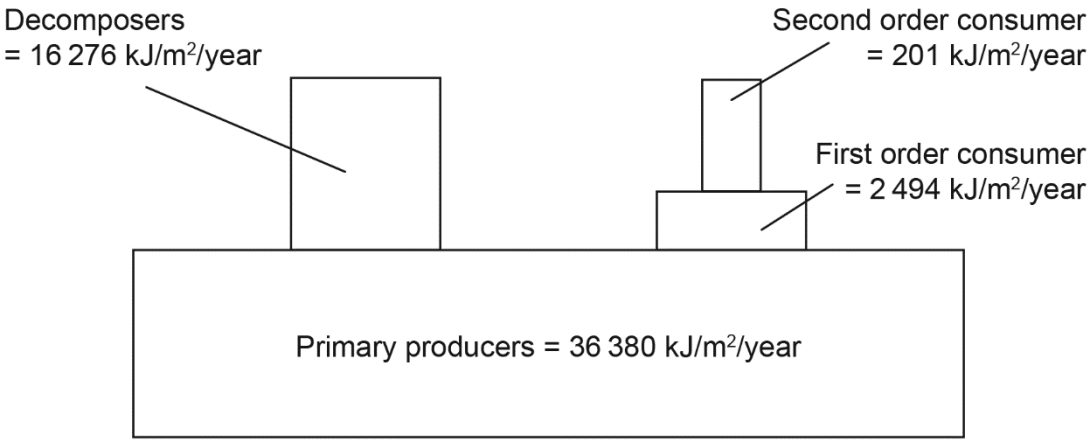
(B) separation

(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%.

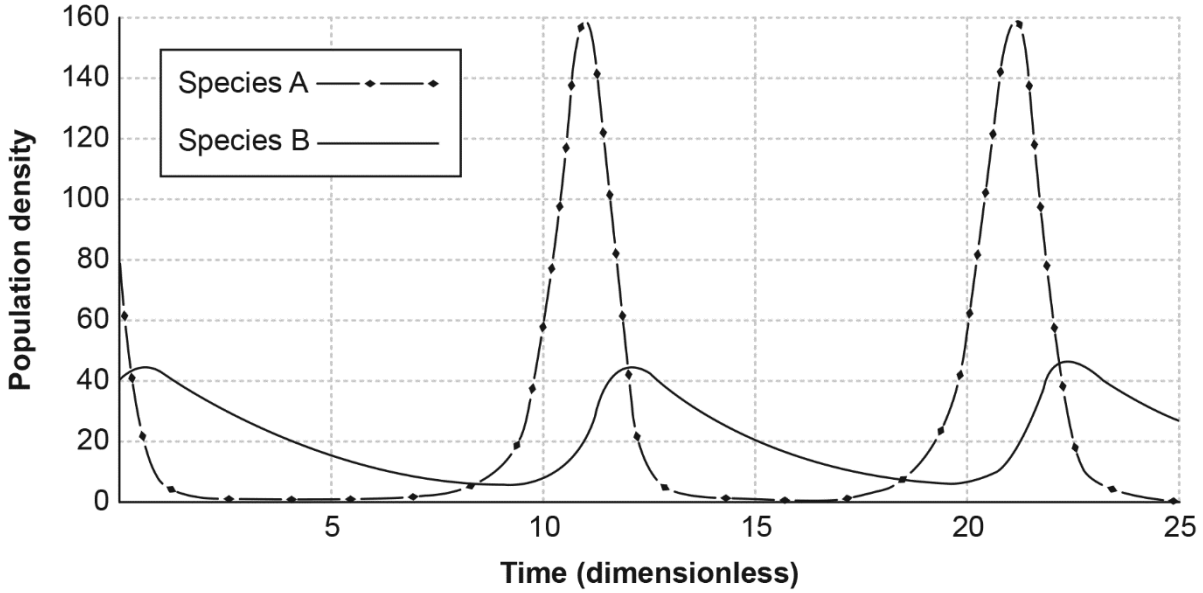
(B) 6.9%.

(C) 7.4%.

(D) 44.7%.

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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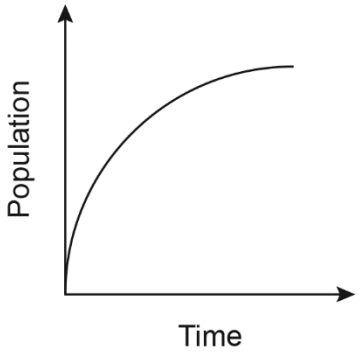
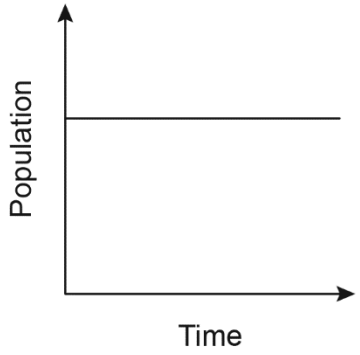
QUESTION 17

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

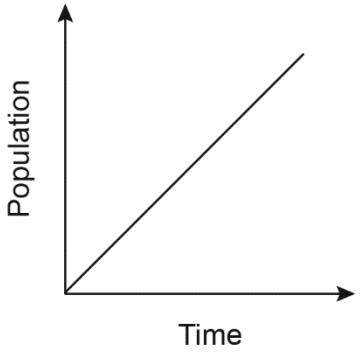
(A)



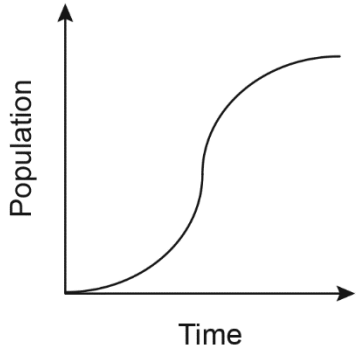
(B)



(C)



(D)



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.

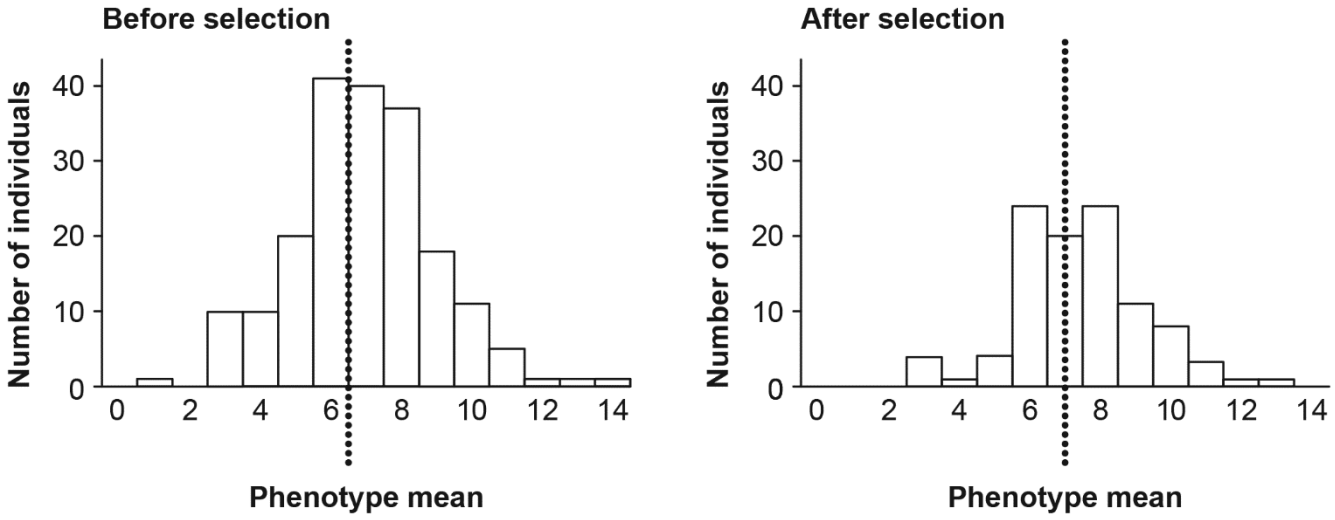
(B) one characteristic controlled by multiple genes.

(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.

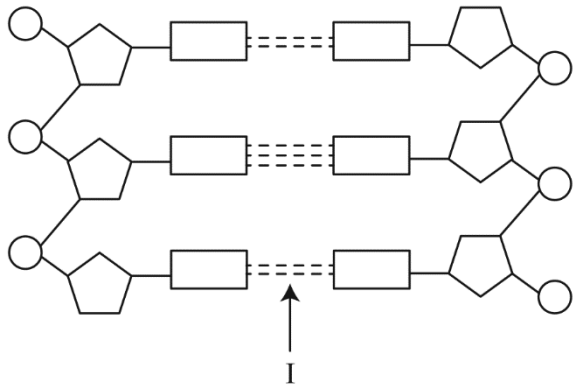
(B) disruptive.

(C) stabilising.

(D) directional.

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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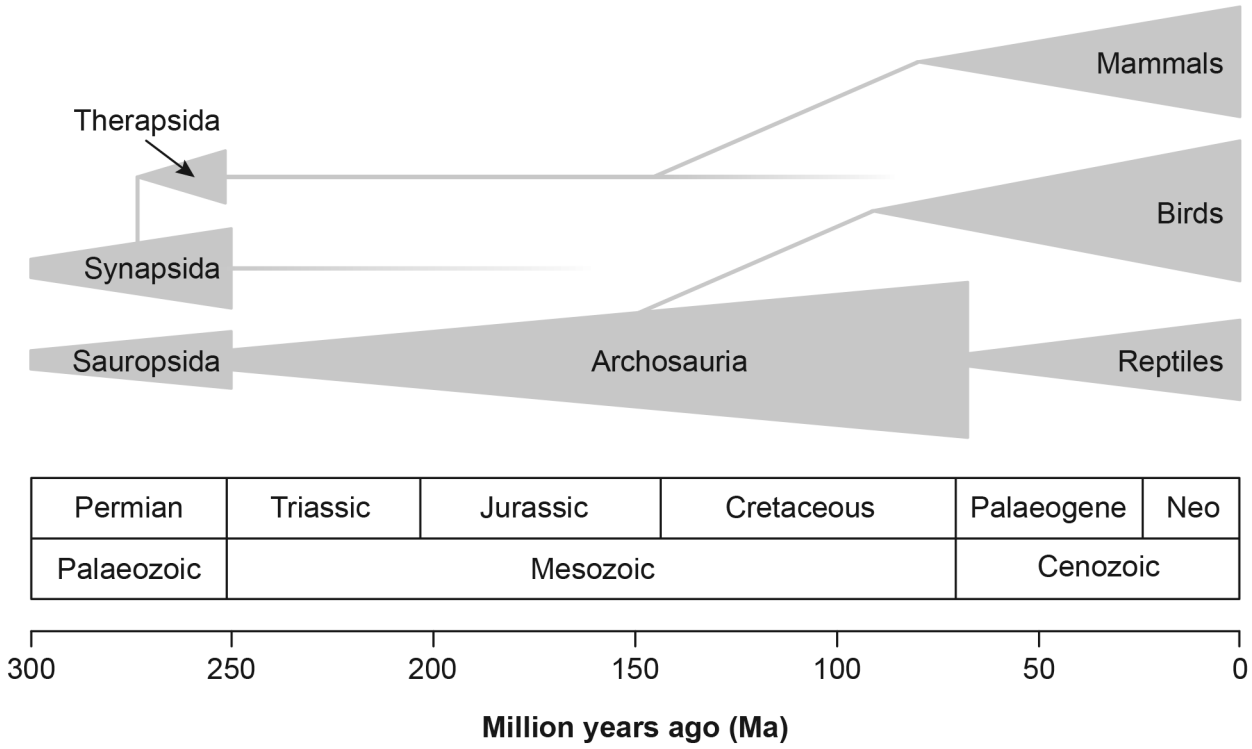
QUESTION 24

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

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.

	Occupant in 50 years			
Present occupant	**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

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/kling/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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