VCE BIOLOGY 2015

YEAR 12 UNIT 4

Topic Test 2 – Change Over Time

Time allowed: 50 minutes
Total marks: 40

14 Multiple Choice Questions
4 Short Answer Questions

An Answer Sheet is provided for Section A.
Answer all questions in Section B in the space provided.

• **Biology** • **Physics** • **Chemistry** • **Psychology**

Student Name....…………………...

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Student Answer Sheet
There are **14 Multiple Choice** questions to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase and enter the correct answer. Marks will not be deducted for incorrect answers.

Question 1	A	B	C	D		*Question 2*	A	B	C	D
Question 3	A	B	C	D		*Question 4*	A	B	C	D
Question 5	A	B	C	D		*Question 6*	A	B	C	D
Question 7	A	B	C	D		*Question 8*	A	B	C	D
Question 9	A	B	C	D		*Question 10*	A	B	C	D
Question 11	A	B	C	D		*Question 12*	A	B	C	D
Question 13	A	B	C	D		*Question 14*	A	B	C	D

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SECTION A – Multiple Choice Questions

Question 1
The gene pool of a vampire bat population can change over time. A factor that makes this vampire bat gene pool less stable is
A.   a large population of vampire bats.
B.   random mating of vampire bats in the population.
C.   a geographical barrier, limiting gene flow.
D.   an increase in vampire bats entering the population from outside the original population.

The following information refers to Questions 2 and 3.
A small population of aye-ayes (Population A) is geographically separated from the parent population (Population B) of aye-ayes due to deforestation in Madagascar.

Question 2
Over time, the two populations of aye-ayes remained separate from each other. Population A is now considered to be a new species. The evidence to support this would be
A.   territorial disputes occurring between individuals from Population A and individuals from Population B.
B.   sexual selection occurred for aye-ayes that had big eyes and large claws.
C.   when individuals from Population A mated with individuals from Population B, no viable or fertile offspring were produced.
D.   when individuals from Population A were reunited with individuals from Population B, individuals from Population A preferred to live on the ground rather than in trees.

Question 3
A few individuals from the small population of aye-ayes then colonised a new area. This is known as
A.   the founder effect.
B.   genetic drift.
C.   bottleneck effect.
D.   selective breeding.

The following information refers to Questions 4 – 6.
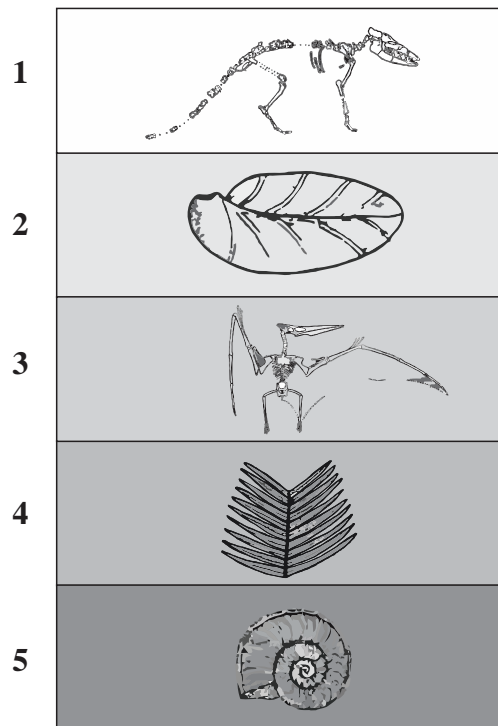
Figure 1: A segment of sedimentary rocks containing fossils

Question 4
In **Figure 1**, you would expect that the oldest fossil would be found in layer
A.   1
B.   5
C.   4
D.   2

Question 5
In **Figure 1**, you would expect to find fossils with the most resemblance to organisms living today in layer
A.   2
B.   5
C.   3
D.   1

Question 6
For an organism's remains to be fossilised in layer 3 of **Figure 1**, there are conditions which are necessary for fossilisation to occur. Which of the following would not favour fossilisation?
A.   A rapid burial of an organism.
B.   A lack oxygen.
C.   A high amount of bacteria present.
D.   The organism lying undisturbed.

*The following information in **Table 1** refers to Question 7.*

Eon	Era	Period	Event
Phanerozoic	Cenozoic	Quaternary	
		Tertiary	First apes
	Mesozoic	Cretaceous	
		Jurassic	
		Triassic	
	Palaeozoic	Permian	
		Carboniferous	
		Devonian	
		Silurian	
		Ordovician	First fish and land plants
		Cambrian	

Table 1: Geological time scale

Question 7
In terms of the geological time scale in **Table 1**, the first mammals would most likely have
been in the
A.   Mesozoic era during the Triassic period.
B.   Cenozoic era during the Quaternary period.
C.   Cenozoic era during the Tertiary period.
D.   Palaeozoic era during the Cambrian period.

Question 8
The difference between relative dating techniques and absolute dating techniques is that
A.   relative dating involves the use of carbon-14 whereas absolute dating involves the use
of carbon-12.
B.   absolute dating involves using radioactive elements whereas relative dating involves
the comparison of rock strata.
C.   absolute dating analyses the rock that the fossil is located in to date fossils whereas
relative dating uses the half-life of isotopes to date fossils.
D.   relative dating involves the use of potassium-87 whereas absolute dating involves the
use of argon-40.

Figure 2 refers to Question 9.
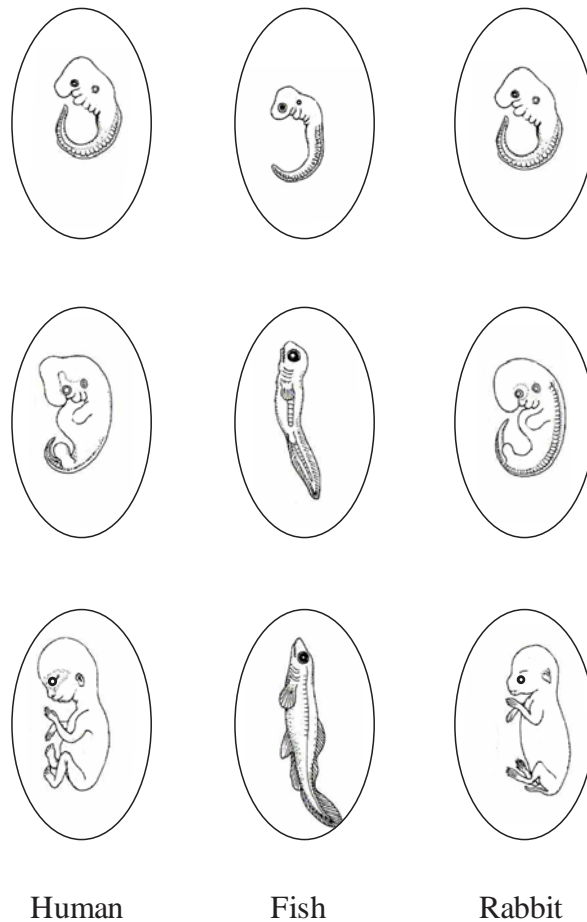
Human   Fish   Rabbit

Figure 2: Embryological stages during human, fish and rabbit development

Question 9
Humans, fish and rabbits have very similar structures and stages of development during early embryogenesis, which can be seen in **Figure 2**. This suggests that
A.   the genes directing the development of the common structures must have been inherited from a common ancestor.
B.   it is only a coincidence that these common structures exist in early embryogenesis, because all three of the organisms turn out to be completely different.
C.   there is evidence to support the theory of biogeography because all of these organisms can be found in Australia.
D.   these organisms all originated during the cretaceous period, leading to a similar embryonic development.

Question 10
Humans, whales and birds have similar forelimb anatomy but the structures have evolved
differently due to
A.   the same selection pressures.
B.   lack of selection pressures.
C.   different selection pressures.
D.   the bottleneck effect.

Question 11
Species 1 and Species 2 do not share a recent common ancestor, but both live in bushland and
have similar phenotypes. This is an example of
A.   biochemical evolutionary relationships.
B.   divergent evolution.
C.   vestigial structures.
D.   convergent evolution.

Question 12
Which of the following is most likely to prevent allopatric speciation from occurring?
A.   Regular gene flow between the parent population and the isolated population.
B.   Geographical isolation.
C.   Reproductive isolation.
D.   Different selection pressures.

Question 13
Mitochondrial DNA has been useful for studying evolutionary relationships. Which of the
following statements is true about mitochondrial DNA?
A.   Mitochondrial DNA can be inherited from either the mother or the father.
B.   In each cell there is a single copy of mitochondrial DNA but multiple copies of
          nuclear DNA.
C.   No crossing over occurs in mitochondrial DNA.
D.   Nuclear DNA has a higher rate of mutation than mitochondrial DNA.

Question 14
The Phanerozoic eon is a period of time dating from the present day to approximately 540
million years ago. In this period of time, there have been several major mass extinctions. The
most recent extinction has been due to
A.   a volcanic eruption.
B.   the impact of humans.
C.   hunting activities of *Australopithecus afarensis*.
D.   a drought.

End of Section A

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SECTION B – Short Answer Questions

Question 1 (7 marks)
In a particular species of ant, individuals can range in colour and can either be black (AA), white (Aa) or grey (aa). On an island, there are two populations of this species, Population M and Population D, which are isolated from each other.

Black   White   Grey
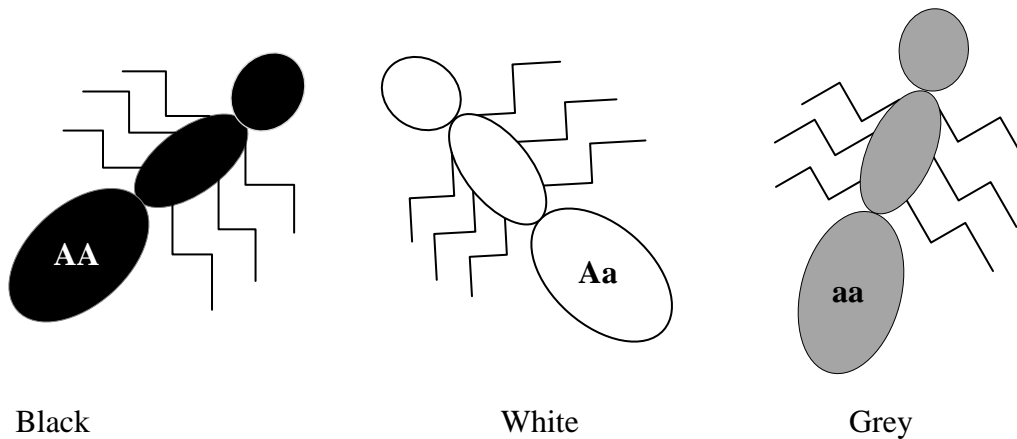
Figure 3

a.   What would happen to the allele frequency in Population M if sparrows in the area had
        a preference for eating grey ants?   **1 mark**

        _____

        _____

        _____

b.   Explain how a bottleneck effect could occur to the ants in Population D. What would
        happen to the genetic diversity in Population D?   **2 marks**

        _____

        _____

        _____

        _____

c.   Explain the difference between the effect that the sparrows have on the population and
        the bottleneck effect on the population.   **2 marks**

        _____

        _____

        _____

d. If this species of ant continued to reproduce over time, explain whether heterozygous (Aa) or homozygous (aa) ants are more likely to survive, assuming the sparrows live near the ants? **2 marks**

_____

_____

_____

_____

Question 2 (7 marks)

The cladogram in **Figure 4**, shows the evolutionary relationships between six modern species of vertebrates. These species all share a common ancestral species (Species L). The six species that evolved from Species L were subjected to different selection pressures.
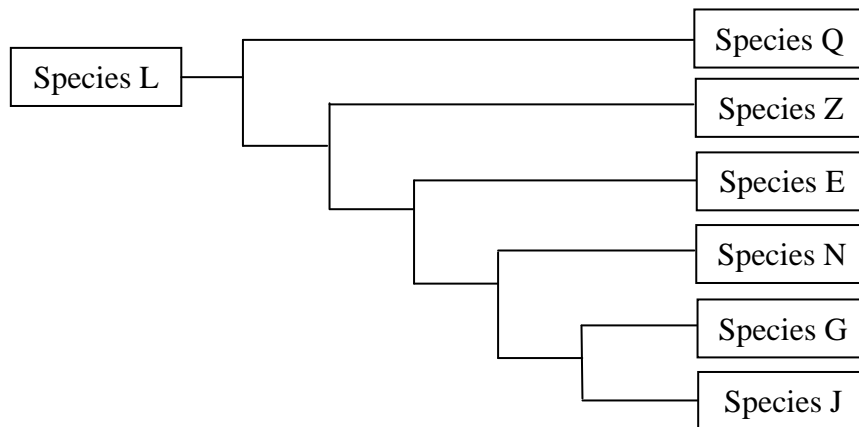

Figure 4: A cladogram

a. Order the six modern species from most closely related to least closely related, starting with Species J. **1 mark**

_____

_____

b. Describe and explain what type of evolution this cladogram depicts. **2 marks**

_____

_____

_____

c. Species L existed approximately 50 million years ago and biologists believe that Species L is ancestral to the six modern species shown in **Figure 4**. State a type of evidence that the biologists may have used to come to this conclusion. In your answer, include a specific example of this evidence that is consistent with the type of evolution shown in **Figure 4**.　**2 marks**

_____

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d. How could a scientist be certain that Species J and G are distinct species? Describe how this speciation event might have occurred.　**2 marks**

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Question 3 (6 marks)

Humans are primates but have features which set them apart from other primates.

a. One of these features is bipedalism. Describe this feature and state one evolutionary advantage it gave humans.　**2 marks**

_____

_____

_____

b. Provide an example of another skeletal feature that sets humans apart from other primates, and state the advantage it provides.　**2 marks**

_____

_____

_____

c. Describe one method that can be used to date fossils.　**2 marks**

_____

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Question 4 (6 marks)

A farmer, John, is interested in producing dairy cows with a high yield of milk production. John buys one cow, 'Cow A', that has a high yield of milk production, and one bull, 'Bull B', that tends to produce two calves, to start his herd. He then mates Cow A with Bull B to produce calves.

a. Name the evolutionary process that John is using. In your answer, state an outcome of this process that would be different when compared to natural evolutionary processes. **2 marks**

_____

_____

_____

b. **i.** After a decade of breeding the cattle, what would happen to the herd if a disease entered the population that both Cow A and Bull B were genetically susceptible to? **1 mark**

_____

_____

_____

ii. Why would you expect this to occur? **1 mark**

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_____

_____

c. List **two** other interventions in natural selection that humans have implemented. **2 marks**

_____

_____

End of Section B

End of Topic Test 2

Suggested Answers

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SECTION A – Multiple Choice Questions

1. D   **2.** C   **3.** A   **4.** B   **5.** D   **6.** C   **7.** A

8. B   **9.** A   **10.** C   **11.** D   **12.** A   **13.** C   **14.** B

SECTION B – Short Answer (Answers)

Question 1 (7 marks)
a. The recessive 'a' allele would decrease in the population and the dominant 'A' allele would increase in the population **(1 mark)**.
b. A bottleneck can occur when there is a catastrophic event such as a volcanic eruption (or tsunami, fire, earthquake and other events that kill a large number of individuals in a random manner, are all acceptable examples) **(1 mark)**. The genetic diversity in Population D would decrease because the proportion of surviving ants would not be representative of Population D before the catastrophic event **(1 mark)**.
c. The sparrows are selective agents that target the aa genotype (grey phenotype) **(1 mark)**. A catastrophic event is not necessarily selective and hence all phenotypes have an equal chance of being affected **(1 mark)**.
d. Heterozygous white (Aa) ants are more likely to survive than the homozygous grey ants (aa) over time **(1 mark)** due to predation of the homozygous grey ants (aa) by the sparrows **(1 mark)**.

Question 2 (7 marks)
a. Species J, Species G, Species N, Species E, Species Z, Species Q **(1 mark)**.
b. Divergent evolution (or adaptive radiation evolution) **(1 mark)** because there is a recent common ancestor and over time, differences have arisen resulting in the evolution of a new species **(1 mark)**.
c. Homologous structures **or** fossil evidence **(Either answer is acceptable however answers referring to molecular evolution are not acceptable, 1 mark)**. Similar bone structure between the forearm of a human and the flipper of a whale **or** the wing of a bat and the front leg of a cat **(students only need one example and there are more possible examples, 1 mark)**.
d. Mating may not occur between the two species **or** if mating is successful with a member of Species J and a member of Species G, the offspring would not be viable or fertile if Species J and Species G are two distinct species **(1 mark)**. They could become separate species if they were geographically and reproductively isolated by a mountain range (or other suitable geographical barrier), resulting in different selection pressures in the two environments **(1 mark)**.

Question 3 (6 marks)

a. Bipedalism is the ability to have locomotion (walk, run, jog, skip) on two feet **(1 mark)**. Advantages: reach higher food (without climbing) **or** better visual field **or** arms become free to be used for alternative activities **(students only need one example and there are more possible examples, 1 mark)**.

b. **Example**: Changes in teeth shape and distribution. **Advantage:** adaptation to a more varied diet that included meat. **Example**: S-shaped spine. **Advantage:** better support of body weight due to bipedalism. **Example**: Legs are comparatively longer than arms. **Advantage:** a longer stride when bipedal **(students only need one example, 1 mark, and one advantage, 1 mark. There are more possible examples)**.

c. Absolute dating **(1 mark)** involves the use of radioactive elements which decay over a known half-life and can provide a numerical estimation of the age of the fossil **(1 mark)**.

or

Relative dating **(1 mark)** which uses geological stratigraphy to compare the rock that the fossil is in to other similar rocks, and provides the historical order that the fossil came in but not a numerical estimation of the age of the fossil **(1 mark)**.

Question 4 (6 marks)

a. The farmer is selectively breeding the cattle rather than allowing the cattle to mate naturally **(1 mark)**. This lessens the biodiversity in the herd, changing the allele frequency and potentially making the cattle more susceptible to pathogens or environmental changes **(1 mark)**.

b. **i.** Most likely, the herd would be wiped out **(1 mark)**.

ii. All of the cattle would have little or no resistance, due to the lack of variation in the herd, for the susceptibility to the disease **(1 mark)**.

c. **Any two of:** use of pesticides, gene therapy, transformation of bacteria, genetic screening, cloning or transgenic organisms **(1 mark for each listed, 2 marks in total)**.

End of Suggested Answers