



# VCE BIOLOGY 2014

## YEAR 12 UNIT 4

### Topic Test 2 – Change Over Time

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**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.**

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**STUDENT NUMBER**

Figures

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Words

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**Student Name**.....**VCE Biology 2014 Year 12 Topic Test 2 Unit 4****Change Over Time****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

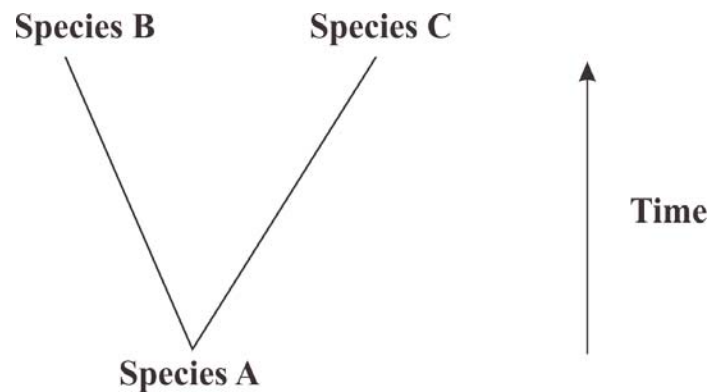
Question 14    A    B    C    D

# VCE Biology 2014 Year 12 Topic Test 2 Unit 4

## Change Over Time

### SECTION A – Multiple Choice Questions

Information relevant to Questions 1-4 is shown in **Figure 1**.



**Figure 1**

#### Question 1

**Figure 1** depicts an example of

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

#### Question 2

If species A was split into two isolated populations of roughly equal size as a result of a volcanic eruption, then the emergence of species B and species C would be an example of

- A. allopatric speciation.
- B. sympatric speciation.
- C. parapatric speciation.
- D. peripatric speciation.

#### Question 3

A stage in human evolution that would best match the evolutionary pathway shown in **Figure 1** would be

- A. *Homo erectus* becoming *Australopithecus afarensis* and *Homo habilis*.
- B. *Australopithecus afarensis* becoming *Australopithecus africanus* and *Homo habilis*.
- C. *Homo habilis* becoming *Australopithecus afarensis* and *Homo erectus*.
- D. *Homo erectus* becoming *Homo sapiens* and *Homo neanderthalensis*.

#### Question 4

The best evidence that would establish that species B and C are distinct species and not two populations or varieties of the same species, would be the following observation:

- A. Species B and C are isolated from each other.
- B. Species B and C, when brought together, cannot produce viable, fertile offspring.
- C. Species B and C have different phenotypes.
- D. Species B and C have different genotypes.

#### Question 5

Cultural evolution differs from biological evolution because cultural evolution

- A. is much slower.
- B. has existed for longer.
- C. only applies to humans.
- D. involves passing information between non-relatives.

#### Question 6

Which scenario best exemplifies cultural evolution?

- A. The transition from hunter-gatherer lifestyles to farming crops such as wheat and barley emerged in the Middle East 10 000 years ago. Since then, farming techniques have rapidly changed and improved.
- B. The manufacture and use of stone tools can be traced back to *Homo habilis*. These tools were simple flint axes and showed little change across the duration of the existence of this species.
- C. Red hair emerged in Europe 100 000 years ago and has existed in humans ever since.
- D. American Pit Bull terriers exist due to the concerted effort to breed the most vicious and strongest dogs together over generations.

#### Question 7

*Homo floresiensis* is a recently discovered hominin who lived on the Indonesian island of Flores and is believed to have become extinct approximately 13 000 years ago. Based on this information, the best radioisotope for dating fossil remains of this species would be

- A. Carbon 14.
- B. Uranium 235.
- C. Potassium 40.
- D. Rubidium 87.

Questions 8 and 9 refer to **Table 1** below. **Table 1** shows the percentage difference in the amino acid sequence of the beta chain of haemoglobin of three different species.

| species | X  | Y   | Z   |
|---------|----|-----|-----|
| W       | 3% | 20% | 32% |
| X       |    | 17% | 31% |
| Y       |    |     | 34% |

**Table 1**

**Question 8**

Which of the following organisms share the most recent common ancestor?

- A. W and Y.
- B. X and Y.
- C. Y and Z.
- D. W and X.

**Question 9**

In no particular order, the haemoglobin molecules in Table 1 belong to mice, humans, chimpanzees and dogs. Which is the most likely identity of the organisms?

- A. W – human, X – dog, Y – chimpanzee, Z – mouse.
- B. W – dog, X – human, Y – mouse, Z – chimpanzee.
- C. W – chimpanzee, X – mouse, Y – human, Z – dog.
- D. W – human, X – chimpanzee, Y – dog, Z – mouse.

**Question 10**

After genetic analysis, it has been found that cheetahs have very low genetic diversity. In fact it has been proposed that, at one time, a single pregnant female may have been the only existing member of the species. This type of situation is best described as an example of

- A. the founder effect.
- B. a bottleneck effect.
- C. natural selection.
- D. gene flow.

**Question 11**

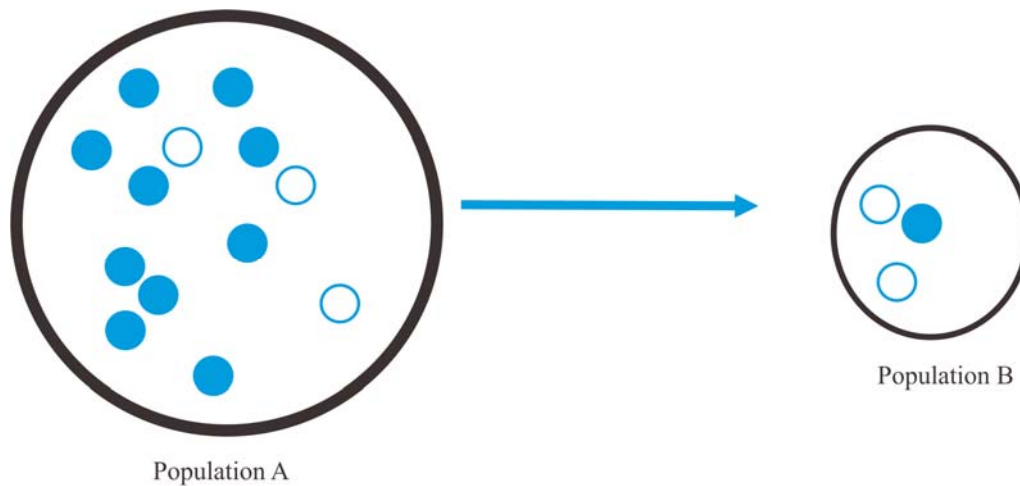
Scientists propose that the origin of modern dogs began with the grey wolf several tens of thousands of years ago. This phylogenetic theory has also been supported by genetic analysis. The evolution of modern dog breeds was driven by human need and involved domestication over many generations. The process which led to the domestication of dogs over many generations and the appearance of many new dog breeds is an example of

- A. random selection.
- B. natural selection.
- C. artificial selection.
- D. hybrid selection.

Questions 12 and 13 refer to **Figure 2**.

**Question 12**

What process which affects allele frequency in a population is illustrated in **Figure 2**?



**Figure 2**

- A. The founder effect.
- B. A bottleneck effect.
- C. Natural selection.
- D. Gene flow.

**Question 13**

Which of the following is true of the process shown in **Figure 2**?

- A. Population B is a new species, distinct from population A.
- B. Population B has a different ratio of alleles compared to population A.
- C. Macro-evolution has resulted in the appearance of population B from population A.
- D. Population B would initially have phenotypes not present in population A.

**Question 14**

When examined closely, it can be seen that blue whales have remnants of hip and leg bones embedded in their blubber. These are examples of

- A. analogous structures.
- B. homologous structures.
- C. vestigial structures.
- D. artificially selected structures.

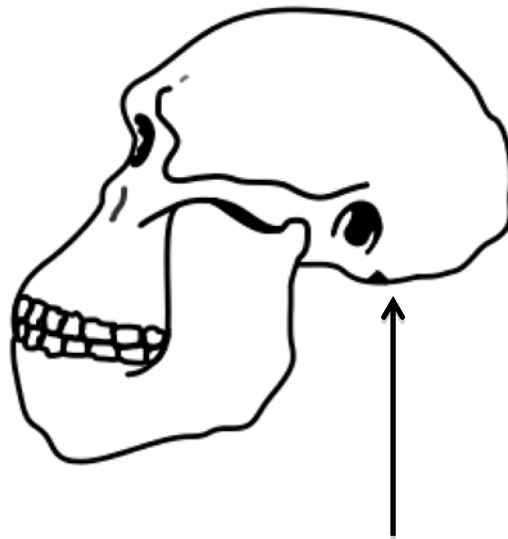
**End of Section A**

# VCE Biology 2014 Year 12 Topic Test 2 Unit 4

## Change Over Time

### SECTION B - Short Answer Questions

#### Question 1 (7 marks)



**Foramen Magnum**

**Figure 3**

The first hominin skull, like the one shown in **Figure 3**, was discovered by Raymond Dart in a lime mine at Taung near Kimberly, South Africa in 1924. It generated great excitement as it was thought to be a transitional fossil on the evolutionary path to *Homo sapiens*.

**a.** What does the term 'hominin' refer to? **1 mark**

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**b.** What does the term 'transitional fossil' mean? **1 mark**

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**c.** Describe two features of the skull shown in **Figure 3** which indicate it is a transitional fossil. **2 marks**

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- d.** To which genus would a hominin with a skull like that shown in **Figure 3** belong? **1 mark**
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- e.** Explain why the position of the foramen magnum is of particular importance when examining potential hominin fossils. Refer to **Figure 3** in your answer. **2 marks**
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**Question 2 (6 marks)**

A rare species of beetle lives in the rainforests of Borneo. This area is undergoing extensive clearing for farmland. This has had the effect of creating many ‘islands’ or isolated pockets of remaining rainforest. Some scientists have hypothesised that this might ultimately lead to this beetle evolving into two or more different species of beetle.

- a.** Provide a definition of the term ‘species’. **1 mark**
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- b.** Describe one limitation with the application of the definition of the term ‘species’. **1 mark**
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- c.** Outline the process that would result in this species of beetle evolving into two new beetle species. **3 marks**
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- d.** What is another likely outcome for this beetle species given the extensive clearing of its habitat? **1 mark**

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**Question 3 (6 marks)**

Recent genetic analysis of a *Homo sapiens* femur fossil, found in South Africa, has revealed its age to be approximately 400 000 years. This has surprised scientists as it was previously thought that *Homo sapiens* evolved no more than 150 000 years ago.

- a.** Briefly describe the two main hypotheses concerning the origins of *Homo sapiens* and their widespread global existence. **2 marks**

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- b.** Which hypothesis does this fossil support? Explain. **2 marks**

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- c.** Previously if a femur fossil thought to be a hominin was dated to 400 000 years in Africa, from what species would it be expected to belong? **1 mark**

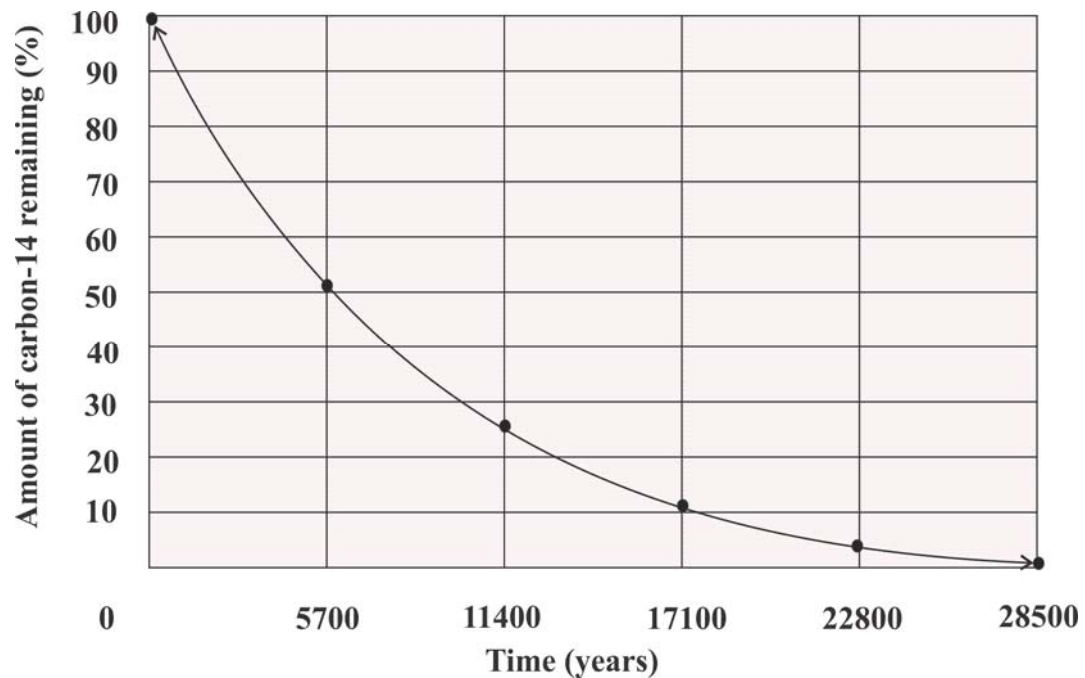
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- d.** Suggest a reason why this example of fossil analysis would not have been possible 10 years ago. **1 mark**

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**Question 4 (7 marks)**

The graph below represents the radioactive decay of carbon-14.



**Graph 1**

- a. What is the name of the type of dating which makes use of radioisotopes such as carbon-14?

**1 mark**

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- b. According to the graph, what is the half-life of carbon-14? Explain how you determined this.

**2 marks**

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- c. If a fossil is found to contain 13% of its original carbon-14 content, approximately how old would it be?

**1 mark**

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- d.** Explain how the decay of radioisotopes can be used to establish the time of death of an organism.

**2 marks**

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- e.** Name one other method of dating fossils.

**1 mark**

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**End of Section B**

**End of Topic Test 2**

## Suggested Answers

### VCE Biology 2014 Year 12 Topic Test 2 Unit 4

#### Change Over Time

##### SECTION A – Multiple Choice Answers

- |      |      |       |       |       |       |       |
|------|------|-------|-------|-------|-------|-------|
| 1. C | 2. A | 3. D  | 4. B  | 5. D  | 6. A  | 7. A  |
| 8. D | 9. D | 10. B | 11. C | 12. A | 13. B | 14. C |

##### SECTION B – Short Answer (Answers)

###### Question 1 (7 marks)

- a. The term 'hominin' refers to various human species and their bipedal ancestors (including the genus *Homo* and genus *Australopithecus*) (1 mark).
- b. The term 'transitional fossil' is a fossil that shows intermediate characteristics between an ancestral species and a later species (1 mark).
- c. The fossil has a small brain case and long 'snout' which are ape-like characteristics (1 mark) and the fossil has a foramen magnum directly below the skull suggesting it was bipedal which is a human characteristic (1 mark).
- d. Australopithecus (1 mark).
- e. The foramen magnum is of particular importance because its position indicates whether the organism is bipedal or not - a defining characteristic of species included in the hominin taxonomic group (1 mark). The skull in **Figure 3** has its foramen magnum centrally located below the skull suggesting it is bipedal whereas if it was positioned toward the back of the skull it would indicate that the organism is a quadruped and thus not a hominin (1 mark).

###### Question 2 (6 marks)

- a. The term 'species' refers to a group of organisms that can produce viable, fertile offspring (1 mark).
- b. This definition presumes the organisms reproduce sexually and doesn't easily accommodate asexual organisms (1 mark).
- c. The original population of beetles contains phenotypic variation (1 mark). It is split into two (or more) populations due to deforestation. Each population is exposed to different environmental conditions and therefore is subject to natural selection acting upon them differently (as well as genetic drift occurring differently) (1 mark). Over time, significant phenotypic change occurs and should the two geographically isolated beetle populations be brought together, successful interbreeding would not be possible (1 mark).
- d. Extinction (1 mark).

**Question 3 (6 marks)**

- a. The 'Out of Africa' hypothesis claims that *Homo sapiens* evolved in Africa and then spread out to other parts of the world from Africa **(1 mark)**. The Multiregional hypothesis claims that *Homo sapiens* evolved in various parts of the world simultaneously from an ancestral species, with some gene flow occurring which ensured that they remained one species **(1 mark)**.
- b. This fossil supports the 'Out of Africa' hypothesis **(1 mark)** because the fact that the oldest known *Homo sapiens* fossil is found in Africa suggests this is where the species evolved **(1 mark)**.
- c. *Homo erectus* or *Homo heidelbergensis* **(1 mark)**.
- d. It was not possible to obtain DNA from a 400 000 year old fossil 10 years ago. A new procedure has enabled this **(1 mark)**.

**Question 4 (7 marks)**

- a. Absolute dating **(1 mark)**.
- b. 5700 years **(1 mark)** because this is how long it takes 50% of the original amount of carbon-14 to decay **(1 mark)**.
- c. 17100 years old **(1 mark)**.
- d. While an organism is alive, it has the same ratio of carbon-14 to carbon-12 as the atmosphere **(1 mark)**. As soon as it dies it ceases to maintain this ratio and the carbon-14 commences to decay and slowly disappear from the organism which is a process that can be quantified to predict the elapsed time **(1 mark)**.
- e. Stratigraphy or electron spin resonance or another reasonable answer **(1 mark)**.

**End of Suggested Answers**