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## BIOLOGY VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2017

### TEST 8: DETERMINING RELATEDNESS BETWEEN SPECIES AND HUMAN CHANGE OVER TIME

TOTAL 40 MARKS (45 MINUTES)

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Student's Name: \_\_\_\_\_ Teacher's Name: \_\_\_\_\_

#### Directions to students

Write your name and your teacher's name in the spaces provided above.  
Answer all questions in the spaces provided.

#### SECTION A – MULTIPLE-CHOICE QUESTIONS

##### Instructions for Section A

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

#### Question 1

A fossil

- A. must be bones.
- B. must be found in a rock.
- C. is any evidence of life existing in the past.
- D. is any living thing.

#### Question 2

Transitional fossils are remains that

- A. do not show change over time.
- B. have traits in common with an ancestral group and a descendent group.
- C. have traits in common with a descendant group only.
- D. do not have traits in common with an ancestral group and a descendent group.

**Question 3**

Which of the following relates to a trace fossil?

- A. could be footprints
- B. gives indirect evidence of life in the past
- C. could be a burrow and associated scrapings
- D. all the above

**Question 4**

The parts of an organisms most likely to be fossilised include

- A. soft tissues.
- B. skin.
- C. hair.
- D. bones.

**Question 5**

Conditions for fossilisation to occur include

- A. lack of scavengers.
- B. slow burial.
- C. abundance of oxygen.
- D. abundance of detritivores.

**Question 6**

If a fossil is thought to be less than 30 000 years old, which type of radioisotope dating should be used?

- A. uranium – lead dating
- B. potassium – argon dating
- C. carbon – nitrogen dating
- D. rubidium – strontium dating

**Question 7**

\_\_\_\_\_ are hominoids, and \_\_\_\_\_ are hominins.

- A. New World monkeys; Old World monkeys
- B. humans; dryopithecine apes and lemurs
- C. apes and humans; australopithecines and humans
- D. gibbons, orangutans and gorillas; chimpanzees, dryopithecine apes and australopithecines

**Question 8**

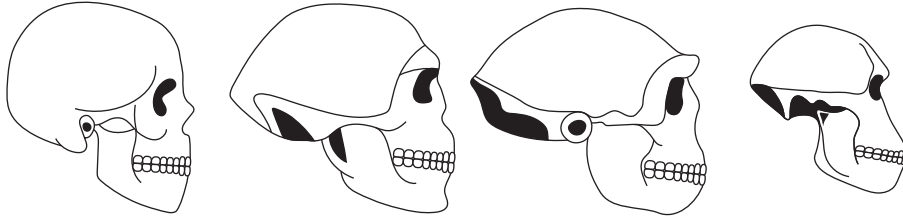
Vestigial structures are remains of structures that

- A. had a function in the evolutionary history of the organism.
- B. have a current function.
- C. never had a function.
- D. were an evolutionary mistake.

**Question 9**

Scientists have found many examples of the fossilised remains of our ancestors going back 10 million years. The fossils include skulls, jaws, teeth and bones. By studying these fossilised human remains and how they have changed, scientists can get an idea how humans might have evolved over the last 10 million years.

Below are drawings of four different hominid skulls.



The similarities between these skulls include the size

- A. of the brow ridge.
- B. of the cranium.
- C. of the lower jaw.
- D. and number of teeth.

**Question 10**

Mitochondrial DNA is inherited from

- A. both parents equally.
- B. ova only.
- C. sperm only.
- D. mother to daughter only.

**SECTION B – SHORT-ANSWER QUESTIONS**

**Instructions for Section B**

Answer **all** questions in the spaces provided. Write using blue or black pen.  
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

**Question 1** (6 marks)

Deoxyribonucleic acid (DNA) is normally a double-stranded molecule; however it can be separated into single strands if the temperature is raised. When the temperature drops, single strands join their complementary partners and become double-stranded again. Scientists can use this process to determine how closely related different species of organisms are to each other. DNA hybridisation is the extent to which pairing of single-stranded DNA from different species occurs.

- a. If a single strand of DNA sequence is A T C G A T C G G A T C, what must the DNA sequence of another single-stranded piece of DNA be for complete DNA hybridisation to occur? 1 mark

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- b. Explain whether single stranded DNA from two humans for the same gene would match exactly if the DNA hybridisation test was carried out. 1 mark

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- c. Explain which pair of organisms would have greater DNA hybridisation. 1 mark  
bat and bird                      dolphin and dog

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- d. Explain why a bird's wing and an insect's wing are referred to as analogous structures. 1 mark

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- e. Explain how a homologous structure differs from an analogous structure. 1 mark

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- f. Why would it be difficult to use DNA hybridisation to determine how closely related two similar looking fossils are? 1 mark

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**Question 2** (3 marks)

- a.** When examining the embryos of vertebrates in early stages of development they appear to be interchangeable.

What does this tell us about the origins of these different species?

1 mark

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- b.** Humans have gill slits at a stage in their development.

Is this statement true or false? What does this indicate in evolutionary terms?

2 marks

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**Question 3** (7 marks)

The molecular clock is a concept used to look at different species and calculate how long they have been separated from a common ancestor.

- a.** What is used to work out the calibration of the molecular clock?

1 mark

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- b.** How can your answer from part **a.** be used to determine how long ago species diverged from a common ancestor?

2 marks

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- c.** Why is mitochondrial DNA a useful tool for molecular clocks for closely related species?

2 marks

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- d.** Mitochondrial DNA is not the only useful tool to calculate how long species have been separated from a common ancestor.  
Describe another useful tool. 1 mark

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- e.** Molecular clocks have enabled palaeontologists to discover the pathways of evolution over millions of years. Epidemiologists can use molecular clocks to follow the spread of disease over smaller time scales, such as decades.  
How is the molecular clock able to trace the spread of disease? 1 mark

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**Question 4 (5 marks)**

- a.** What is a master gene? 1 mark

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Bone Morphogenic Protein 4 (BMP4) is a protein-coding gene. In humans, its expression includes cartilage and bone formation. The expression of BMP4 is also involved in limb formation and fracture repair amongst other pathways. This gene is present and expressed in many other species who exhibit very different morphology to humans. The expression of BMP4 is involved in beak formation of Galapagos finches and in jaw formation of cichlid fish.

- b.** Describe how the expression of the same gene in these different species can result in very different morphology end products. 3 marks

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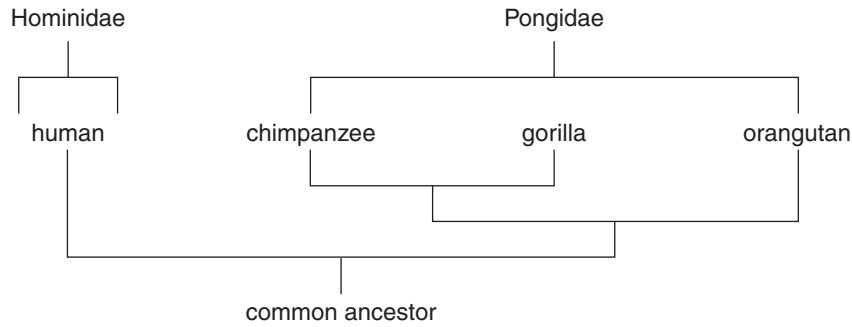
- c.** Master genes are subject to mutation.  
Give a suggestion of a morphological change in a human if the BMP4 gene contained a mutation. 1 mark

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**Question 5** (6 marks)

Among living primates, the apes that are most similar to humans are the chimpanzee, the gorilla, and the orang-utan. All three of these apes live in tropical forests and spend considerable time climbing in trees to collect food and to avoid large predators. Traditionally, the apes have been classified together in the family Pongidae, on the assumption that they are more closely related to each other than to humans (the family Hominidae). The proposed relationship is summarised as an evolutionary tree below.



Not all phenotypic characteristics support this proposed relationship. The table below lists some of the phenotypic characteristics that vary among humans and apes.

Phenotypic character	Human	Chimpanzee	Gorilla	Orang-utan
arm length	shorter than leg	longer than leg	longer than leg	longer than leg
enamel on molar teeth	thick	thin	thin	thick
sinuses in bones of forehead	present	present	present	absent
brow ridges	weak	strong	strong	weak
pelvis	rounded	elongated	elongated	elongated

- a.** List two phenotypic characteristics which support the classification of humans into family Hominidae and chimpanzees, gorillas and orangutans into family Pongidae. 2 marks

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- b.** List **one** phenotypic characteristic that does not support this classification. 1 mark

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- c.** Using the characteristic you identified in part **b.**, draw a cladogram positioning the four species. 1 mark

Biologists can now compare the DNA of different species and see how many of the nucleotides are the same. When the nucleotides in a number of human genes are compared with those in the same genes of apes, the results are shown below.

Chimpanzee	Gorilla	Orang-utan
98.7	98.4	96.8

- d.** Based on the information in the table, with which of the three species shown do humans share a more recent common ancestry? 1 mark

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- e.** Why is a comparison of DNA more reliable than a comparison of phenotypic characteristics in determining the evolutionary relationship between species? 1 mark

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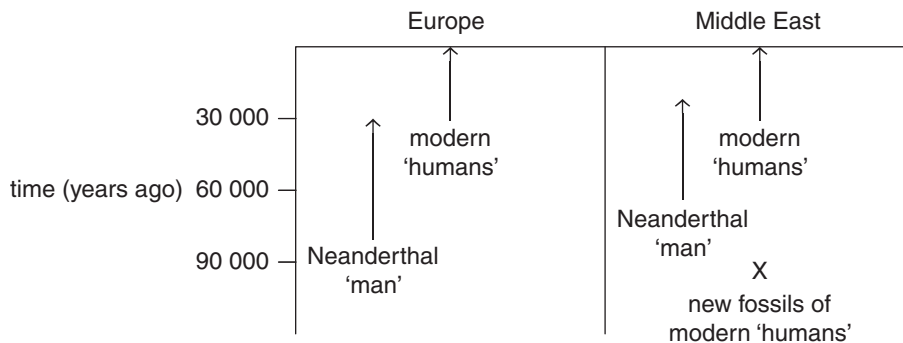
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**Question 6** (3 marks)

The diagram below shows the distribution in time of a group of fossils that has been discovered in Europe and the Middle East and classified as *Homo sapiens*. Newly discovered fossils identified as modern humans were uncovered in the Middle East and dated at 90 000 years ago.



- a.** What information could support the hypothesis that modern humans migrated from the Middle East to Europe? 1 mark

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- b.** What does the information in the diagram suggest about the direction of migration of Neanderthals? 1 mark

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- c. Based on the information in the diagram, would it be valid to say that Neanderthals were ancestral to modern humans? Explain. 1 mark

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