Student Name: _____

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BIOLOGY 2016

Unit 4
Key Topic Test 6 – Evolution and the evidence for evolution

Recommended writing time*: 45 minutes
Total number of marks available: 45 marks

QUESTION BOOK

* The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

Conditions and restrictions

- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.
- No calculator is permitted in this test.

Materials supplied

- Question and answer book of 12 pages.

Instructions

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.

SECTION A – Multiple-choice questions

Instructions for Section A

Select the response that is **most correct** for the question. A correct answer scores 1, an incorrect answer scores 0. Marks are not deducted for incorrect answers. If more than 1 answer is completed for any question, no mark will be given.

Question 1

Which of the following statements about the evolution of genes is correct.

A. Mitochondrial genes were evolved to assist in the production of glucose
B. Ribosomal RNA genes evolve at a slower rate than mitochondrial genes
C. There are thousands of chloroplast genes that enable cellular functions to occur
D. Both mitochondrial genes and chloroplast genes were developed from nuclear genes

Question 2

During the 1800's different scientists proposed different theories of evolution. Which of the following theories supports today's scientific understanding of evolutionary processes?

A. Organisms are unable to evolve within their own lifetime, however, changes to offspring occur in future generations.
B. Organisms are able to adapt to their environment through genetic changes to suit their own environment better.
C. Organisms acquire adaptations throughout their lifetime and pass these on to the next generation of offspring
D. Organism develop multiple mutations that are always selected for and this increases the diversity in the population leading to evolution.

Question 3

Stratification of rock with fossil evidence present in different layers are able to suggest:

A. Relative ages of fossils
B. The geological ages of the fossils
C. The absolute ages of the fossils
D. The radiometric dating of the fossils

Question 4

The principal of superposition in relation to rock strata outlines that:

A. The oldest layers are found on the top of the formation
B. The youngest layers are found on the bottom of the formation
C. The middle layers are formed through successive layering of new materials
D. The layers are formed through the movement of the older rock up to the surface of the formation

Use the following information to answer questions 5 and 6

Redlichia takooensis is an ancient trilobite from the lower Cambrian period around 550-488 million years ago. Fossils of a twelve centimetre creature were found on Kangaroo Island in New South Wales, Australia in the 1950's. The remains were imprinted into rock formations and have a highly segmented body with many leg like appendages. The following is a diagram of the *Redlichia takooensis* fossils found in the region.

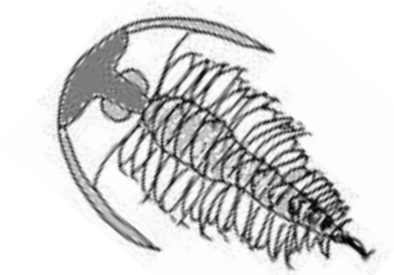


Diagram 1. *Redlichia takooensis* fossil

Question 5

Which of the following characterises would have allowed the clear formation of *Redlichia takooensis* fossils in shale rock?

A. Many leg like appendages
B. A hard exoskeleton
C. A highly segmented body
D. A large population size

Question 6

Scientists are attempting to determine the age of *Redlichia takooensis*, which of the following methods would be most appropriate achieving this?

A. Carbon-14 dating with a half life of 5730 years
B. Potassium-argon dating with a half life of 1300,000,000 years
C. Thermoluminescent dating
D. Electron spin resonance

Question 7

Indirect signs of fossil evidence such as footprints are known as:

A. Trace fossils
B. They are not fossils
C. Index fossils
D. Mould fossils

Use the following information to answer questions 8 and 9

The table below represents the analysis of several proteins found in four species of mammals.

	Mammal 1	**Mammal 2**	**Mammal 3**	**Mammal 4**
Protein A	Absent	Present	Modified	Absent
Protein B	Modified	Present	Present	Absent
Protein C	Present	Present	Absent	Present

Question 8

Which of the mammal species are most closely related based on their protein analysis?

A. Mammal 1 and 2
B. Mammal 2 and 4
C. Mammal 3 and 2
D. Mammal 4 and 1

Question 9

The study that has been undertaken to determine the relatedness of the mammal samples is known as:

A. Molecular homology
B. Comparative genomics
C. DNA hybridisation
D. Polymerase chain reaction

SECTION B- Short-answer questions

Instructions for Section B

Answer all questions in the spaces provided.

Question 1 (5 marks)

The white water lily, *Nymphaea alba*, is a hydrophyte that is able to float on top of water due to its various adaptations. There are around 50 species of the water lilies that have air spaces within their leaf structure that give the flower a buoyant surrounding.

a. Define adaptation

_____

_____

_____

1 mark

b. Whilst all species share the buoyant leaf structure and some other characteristics, they do not all have the exact same features. What type of evolution is this an example of?

_____

1 mark

c. The spread of the species can be easily identified in African regions. Scientists that study the spread of the water lily species would be undertaking what area of scientific study?

_____

1 mark

d. Whilst the flowers of the water lily are hermaphrodite and are capable of reproducing on their own, they grow the male and female parts at different times to reduce the chance of self-pollination. Explain how sexual reproduction would be beneficial for the survival of the water lily species.

_____

_____

_____

_____

2 marks

Question 2 (8 marks)

Angiosperms, commonly known as flowering plants, are an evolutionary masterpiece that have evolved over 140 million years into around 250,000 species living today. There are also many more that no longer exist due to extinction. Some of the oldest living angiosperms are the North American aspen trees that are estimated to be around 10,000 years old. Fossil records indicate that one type of angiosperm, the magniliids evolved around 100 million years ago as a simple flower and now boast a range of intricate detailed structures on modern day plants such as the Australian scented Ylang-ylang plant.

a. Whilst only fossils have been examined in angiosperms.

i. Name an absolute dating technique would be most appropriate to accurately date the oldest samples?

_____

1 mark

ii. Name an absolute dating technique that would be most appropriate to accurately date the American aspen tree fossil samples?

_____

1 mark

b. What type of fossil evidence may have been found of the early angiosperms?

_____

1 mark

c. It has been suggested by scientists that there may not be a fossil record of angiosperms before 140 million years ago due to the harsh dry environments. Explain the rationale behind this statement.

_____

_____

_____

1 mark

d. The majority of fossils found from plant tissue are ferns and bark rather than flowers. Explain why this may be the case.

_____

_____

_____

1 mark

e. Outline a key difference between absolute dating and relative dating.

_____

_____

_____

2 marks

f. Some Angiosperms are capable of producing very high pollen counts that float through the air. Outline an evolutionary benefit of angiosperms that are capable of doing this.

_____

_____

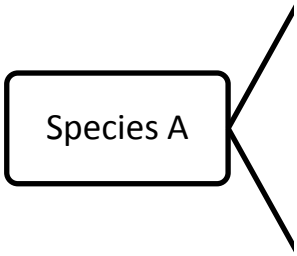
_____

1 mark

Question 3 (17 marks)

The evolution of Mexican cave fish has been a well-documented area of study surrounding the idea that animals adapt to their environments over periods of time. The following diagram and table of information is an outline based on the evolution of Mexican cave fish.

Diagram 2. Relatedness of Mexican cave fish



Species	Characteristics
A	Normal body coloring, functional eye present
B	Absence of body coloring, functional eye present
C	Normal body coloring, non-functional eye
D	Normal body coloring, no eye present
E	Absence of body coloring, no eye present
F	Absence of body coloring, no eye present

a. Explain the idea that animals adapt to their environments over a period of time.

_____

_____

_____

2 marks

b. What is the scientific name given to diagram 2?

_____

1 mark

c. Explain two features of diagram 2 that makes it a useful tool for understanding relationships between organisms.

_____

_____

_____

2 marks

d. Which species of cave fish no longer exist?

_____

1 mark

e. Explain the evolutionary relationship between species C and D.

_____

_____

_____

1 mark

f. Species E and F share the same characteristics. Name and explain the evolutionary relationship between these two species that has led to these similarities

_____

_____

_____

2 marks

g. Which species survived the longest period of time?

_____

1 mark

h. DNA hybridization was undertaken to determine the relationship between species A, C and D. It was found that species A and C were actually the same species.

i. Outline the use of DNA hybridization as a technique for determining evidence of evolutionary relationships.

1 mark

ii. Name and outline one other molecular technique that could have also been used to determine relationships between the cave fish.

2 marks

iii. Explain a possible reason as to why scientists may have thought that species A and C were entirely different species?

1 mark

i. Explain how the characteristics of species E arose over time from the starting point of species B?

3 marks

Question 4 (5 marks)

The following diagram is a generalized structure of the Pentadactyl limb. Various adaptations of this limb are found in different mammal species, often serving very different functions. Both the human hand and a bats wing are examples of the Pentadactyl limb being utilized for different functions despite having the same general structure.

a. What type of evolutionary structure is the Pentadactyl limb?

_____

1 mark

b. What type of evolution does the Pentadactyl limb support?

_____

1 mark

c. Outline the evolutionary process that is named in part b.

_____

_____

_____

1 mark

d. Other animals may exhibit a similar function to Pentadactyl limb in a bats wing, however, they do not possess the same general structure. What is the name given to these types of structures?

_____

1 mark

e. What type of evolutionary process does the other animal's similar function support?

_____

1 mark

END OF KEY TOPIC TEST