

2009

TERM 3

PRELIMINARY COURSE
EXAMINATION

BIOLOGY

General Instructions

- Reading time – 5 minutes
- Working time – 75 minutes
- Write using black or blue pen

- Draw diagrams using pencil
- Write your Student Number on the Part A Answer Sheet and the Part B Question and Answer Book

Total marks for this paper: 53

This paper has two parts, Part A and Part B

Part A

Total marks (10)

- Attempt all 10 questions in this part
- Allow about 15 minutes for this part

Part B

Total marks (43)

- Attempt all questions
- Allow about 60 minutes for this part

Part A

Total marks (10)

Attempt all questions

Each question is worth one mark

Allow about 15 minutes for this part

Use the Part A Answer Sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely using ink.

Sample $2+4=$ (A) 2 (B) 6 (C) 8 (D) 9

A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct

A B C D

1. What is the current model for the evolutionary sequence of life forms (Stage 1 to Stage 6)?

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
(A)	organic molecules (4.5 bya)	heterotrophic prokaryotes (3.6 bya)	autotrophic prokaryotes (3 bya)	eukaryotes (2 bya)	colonial organisms (1.3 bya)	multicellular organisms (600 mya)
(B)	organic molecules (4.5 bya)	autotrophic prokaryotes (3.6 bya)	heterotrophic prokaryotes (3 bya)	eukaryotes (2 bya)	colonial organisms (1.3 bya)	multicellular organisms (600 mya)
(C)	organic molecules (5.5 bya)	heterotrophic prokaryotes (4.6 bya)	autotrophic prokaryotes (3 bya)	eukaryotes (1 bya)	colonial organisms (600 mya)	multicellular organisms (200 mya)
(D)	organic molecules (4.5 bya)	heterotrophic prokaryotes (3.6 bya)	autotrophic prokaryotes (3 bya)	colonial organisms (2 bya)	eukaryotes (1.3 bya)	multicellular organisms (600 mya)

Note: bya = billions of years ago; mya = millions of years ago.

2. Unicellular algae called zooxanthellae live within the bodies of marine invertebrates, including sponges, jellyfish, sea anemones, corals, gastropods and turbellarians. The photosynthetic activity of these algal cells is vital to the survival of the individual coral animals and to the entire reef ecosystem. What type of interaction is represented by this information?

- (A) allelopathy
- (B) predation
- (C) mutualism
- (D) parasitism

3. Which is the correct classification hierarchy as devised by Carolus Linnaeus?

- (A) kingdom → phylum → family → genus → species
- (B) phylum → class → order → family → species → genus
- (C) kingdom → phylum → class → order → family → genus → species
- (D) kingdom → family → order → class → phylum → genus → species

4. The trophic levels for an aquatic ecosystem are shown in the table.

Primary Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer
aquatic plants	caddisfly larva	bluegill	large mouth bass

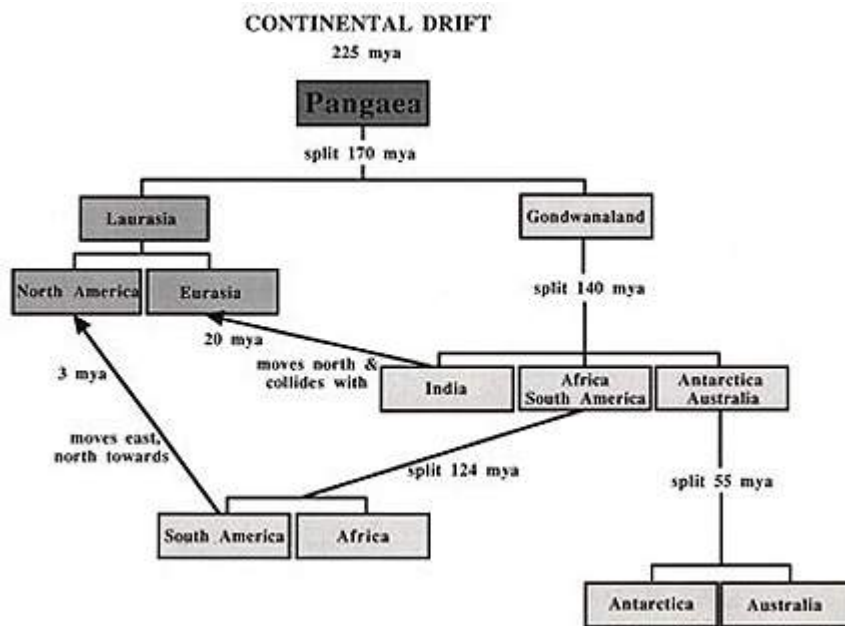
What would be the amount of energy contained and approximate number of organisms for the trophic levels of primary producer and tertiary consumer?

	Primary Producer		Tertiary Consumer	
	Energy (kJ m ² /yr)	Number	Energy (kJ m ² /yr)	Number
(A)	67	316	7,851	1890
(B)	813	1010	70	6
(C)	8,833	11,977	6	13
(D)	11,977	8,633	78	316

5. Which substance is formed as a result of aerobic cellular respiration in plants?

- (A) ATP
- (B) glucose
- (C) oxygen
- (D) starch

Questions 6 and 7 refer to the following figure which shows a summary of continental drift events on Earth over a period time.



6. What is the best type of geological evidence for this summary of events?
- (A) A spreading zone occurs in between India and Australia; formation of Himalayan Mountains.
 - (B) A mid-ocean ridge occurs in between Africa and South America; a spreading zone occurs between North and South America.
 - (C) The formation of a large mountain range in Antarctica.
 - (D) The formation of mid-ocean ridge in between Africa and South America, and in between Australia and Antarctica.
7. What type of paleontological evidence indicates the existence of Gondwanaland?
- (A) On either side of a mid-ocean ridge are symmetrical patterns of magnetic bands in rocks.
 - (B) Matching continental margins for Australia, Africa, Antarctica, India and South America.
 - (C) Fossils of *Glossopteris* have been found on Australia, Africa, Antarctica, India and South America.
 - (D) The existence of marsupial fossils of the same age on Australia and Antarctica.

8. Two theories for the evolution of organic molecules on Earth are the Chemosynthetic theory and Panspermia theory. What are the features of each theory?

	Chemosynthetic theory	Panspermia theory
(A)	Organic molecules on Earth may have come from outer space.	Carbon compounds arise spontaneously from matter.
(B)	Carbon compounds arise spontaneously from matter.	Reactions in the early Earth atmosphere formed organic molecules.
(C)	Chemical reactions in the early Earth atmosphere formed organic molecules.	Organic molecules on Earth may have come from outer space.
(D)	Chemical reactions in the early Earth atmosphere formed oxygen.	Meteorites contained primitive procaryotes.

9. Which abundance sampling method should be used if the population to be investigated is a plant species thought to be scattered over a large area (400 km²) and its numbers too large to be counted directly?

- (A) Capture-recapture
- (B) Direct count
- (C) Line transect
- (D) Quadrat sampling

10. What role do decomposers play in ecosystems?

- (A) Decomposers are bacteria and fungi in soil and water
- (B) Decomposers contribute to the recycling of materials
- (C) Decomposers live on dead organic matter
- (D) Decomposers are the end of the food chain

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Student Number

Part A Answer Sheet

Write your Student Number at the top of this Part A Answer Sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely using ink.

1. A ○ B ○ C ○ D ○
2. A ○ B ○ C ○ D ○
3. A ○ B ○ C ○ D ○
4. A ○ B ○ C ○ D ○
5. A ○ B ○ C ○ D ○
6. A ○ B ○ C ○ D ○
7. A ○ B ○ C ○ D ○
8. A ○ B ○ C ○ D ○
9. A ○ B ○ C ○ D ○
10. A ○ B ○ C ○ D ○

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Write your Student Number at the top of this Part B Answer Sheet.

Student Number

Part B

Total marks (43)

Attempt all questions

Marks vary for each question

Answer the questions in the space provided

Allow about 60 minutes for this part

Question 1 (2 marks)

The pictures below are of four aquatic invertebrates.



African giant water bug (2 pictures)



amphipod side swimmer (2 pictures)



Water mite



Beetle

In the space below, construct a dichotomous key in order to key out each organism.

Question 2 (4 marks)

Discuss the impact of advances in technology on the development and revision of biological classification systems.

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Question 3 (5 marks)

Complete the table in order to compare different types of procaryotes with respect to the environment they inhabit and their roles within the environment. Classify each procaryote according to the 6-kingdom classification scheme.

Procaryote	Kingdom classification	Environment features	Role of procaryote in environment
methanogens			
nitrogen-fixing bacteria			

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Write your Student Number at the top of this Part B Answer Sheet.

Student Number

Question 4 (3 marks)

Charles Darwin visited Australia in 1836 and the observations he made of Australian flora and fauna are thought to have contributed towards the development of his theory of evolution.

Explain how Darwin interpreted his observations of Australian organisms in terms of his theory of evolution.

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Question 5 (4 marks)

Fossil evidence indicates that the distribution and abundance of Australian native flora and fauna have changed over the past 40 million years. Describe two theories that account for these changes.

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Question 6 (4 marks)

Most of the evidence for the origin and evolution of life on Earth has been obtained from palaeontological and geological sources.

- (a) Describe one piece of palaeontological evidence for the origin of procaryotes. (2 marks)

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- (b) Describe one piece of geological evidence for the evolution of procaryotes. (2 marks)

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Question 7 (4 marks)

Discuss current research into the relationships between an extinct Australian species with an extant species.

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Question 8 (4 marks)

Using the Platypus as an example, describe how the ideas that scientists held about an individual species have been altered as a result of new information and technologies.

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Write your Student Number at the top of this Part B Answer Sheet.

Student Number

Question 9 (4 marks)

Evaluate the impact of environmental changes on the evolution of extinct Australian flora and fauna.

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Question 10 (2 marks)

Describe one type of fossil evidence that supports the assertion that Australia was once part of a giant landmass called Gondwana.

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Question 11 (2 marks)

The grey mangrove was studied at the Field of Mars ecosystem. Describe one adaptation that this tree has that enables it to survive in its environment.

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Question 12 (2 marks)

The table displays the trophic levels in a mangrove ecosystem.

producer	first order consumer	second order consumer	third order consumer	fourth order consumer
algae	prawns	oyster catcher (bird) (feeds on oysters)	bream (feeds on small fish)	cormorant (bird) (feeds on bream, small fish)
	oysters	small fish (feeds on prawns)		

Construct a food web for the community described in the table.

Question 13 (2 marks)

Living marsupials are only found in Australia and South America.

- (a) Describe one important classification feature of marsupials that distinguishes them from other mammals. (1 mark)

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- (b) Explain why living marsupials are only located in Australia and South America. (2 marks)

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End of Exam

Part A

	A	B	C	D
1	X			
2			X	
3			X	
4			X	
5	X			
6				X
7			X	
8			X	
9				X
10		X		

Part B

1. Legs protrude laterally/legs protrude vertically (amphipod) → rectangular-shaped body (beetle)/body not rectangular → pincer-like rear legs (Water bug)/rear legs not pincer-like (water mite).

Dichotomous nature of key (1). Each organism is able to be keyed out (1).

Unacceptable: terrestrial vs water; hard shell vs soft shell; swimming on side.

2. Advent of the light microscope enabled reclassification of two kingdom classification (plants, animals) scheme into 3-kingdom (unicellular, plants, animals). The light microscope enabled scientists to identify single cell organisms. Biochemical technology has enabled the reclassification of Kingdom Monera into two kingdoms: Archaea and Eubacteria. Thus the 5 kingdom classification scheme (Monera, Fungi, Protists, Plants, Animals) has been altered to the 6 kingdom scheme. Biochemical analysis revealed differences between the Eubacteria and Archaea bacteria with regards to the ribosomal RNA and the chemicals that make their cell wall (murein).

C (1): old classification to new classification

T (1): technology used to revise the classification scheme

C (1): old classification to new classification

T (1): technology used to revise the classification scheme

Note: if using “biochemical technology” must state the specific changes observed such as ribosomal RNA or murein. “Chemical” differences is not acceptable.

Acceptable: electron microscope allowed identification of membrane-bound organelles; cell ultrastructure.

3.

Prokaryote	Kingdom classification	Environment features	Role of prokaryote in environment
methanogens	Archaea (1)	bogs, deep soils, sewage treatment, intestinal tracts (herbivores) (1)	digestion in herbivores, contribute methane to carbon cycle, decomposition of organic matter (1)
nitrogen-fixing bacteria	Eubacteria	soil, root nodules of plants (legumes) (1)	Convert nitrogen in air to nitrates and ammonium (1)

4. Darwin's theory of Natural Selection provided a mechanism by which evolution can occur. According to natural selection, organisms that have adaptations that enable them to survive in their environment will survive to reproduce and thus their offspring will inherit the favourable characteristics. Darwin's visit to Australia helped to develop his theory in several ways. (1) He observed some Australian organisms to be very similar to organisms on other continents e.g., the magpie resembled the crow in England. Darwin reasoned that these organisms were similar since they lived in similar environments and thus evolved to resemble each other. This represented a form of convergent evolution and demonstrated the selective pressure that the environment has on the evolution of organisms. (2) He observed some unique creatures such as the platypus and kangaroo and suggested that these organisms had evolved to suit the harsh, dry Australian environment; they had adaptations that enable them to survive in Australia. (3) Some organisms that resembled organisms from other countries may do so since they had common ancestry.

N (1): natural selection described e (1): example e (1): example e (1): example

5. Theory 1: drying of the Australian environment as it drifted north due to plate tectonics. This led to sparse vegetation. Alternate: ice ages caused drying out of Australia.

Theory 2: hunting by Aboriginal people destroyed megafauna; used fire which burnt the plants.

E1 = identified change for theory 1 R1 = reason for the change

E2 = identified change for theory 2 R2 = reason for the change

6. (a) Microfossil of bacteria found in chert (1) of WA was found to be approximately 3,465 million years old (1). Thus procaryotes are at least 3.5 byo.

Note: must provide correct date. Maximum of (1) if stromatolites used and the date provided is about 3 bya (not 3.5 bya).

(b) Iron oxide banding in rocks are evidence of oxygen-producing cells such as cyanobacteria. Thus, oldest procaryotes evolved into autotrophic bacteria (cyanobacteria).

(1): band iron formations

(1): evidence heterotrophic to autotrophic procaryotes

7. Modern kangaroo (extant: research about the type of ancestors of the modern kangaroo is ongoing. E.g., fossils found at Riversleigh show that the Bulungamyines rather than the Balbarines are the closest ancestors of the modern kangaroo. The shapes of skull bones and molars of the Bulungamyines are more similar to the modern kangaroo than those of the Balbarines. Bulungamyine fossils are more common in younger rocks than the Balbarines.

A: Balbarines

B: Bulungamyines

E: evidence (skull bones)

E: evidence (teeth)

Note: (1): weak description provided with no names of species of explicit evidence provided.

8. Platypus: In the early 1800s, scientists were baffled by the characteristics that the platypus had. It had some features similar to mammals – fur and being endothermic – yet it had other features that were not associated with mammals. For example, it had a single chamber that appeared to be used for both reproduction and excretion, which is unlike other mammals that give birth to live young. This was reptilian-like (1). The platypus is unique since the scientific classification system in that time considered the reproductive systems important in classifying. Cladwell in 1884 studied platypuses and found they lay eggs (1). Technology has enabled a better understanding of the platypus since then. In the 1980s, the nocturnal nature of the platypus was understood by finding that the platypus has an electro-receptor system in its bill, *enabling it to detect prey* (worms, yabbies(1). Or, the body temperature of the platypus can *drop and remain low for several days* (torpor) during the winter. Temperature sensors enable scientists to find this feature.

O (1): old scheme classification features given (reptilian-like, or bird-like)

M (1): monotreme confirmed

T (1): recent technological-associated discovery described

T (1): technology used stated OR (1): elaboration of technology-associated discovery “...electro-receptor in bill helps platypus find prey at night.”

9. (1) F: Australia became hotter and dryer as it drifted north. (Reason for change in Australian flora.)

(1) P: rainforests that once covered across Australia dried out and now only occur along the coastal regions. Seed fern *Glossopteris* existed throughout Australia but it is now extinct.

(Change/evolution of Australian flora.)

(1) M: megafauna died out/current fauna are smaller versions of megafauna (Change in Australian fauna.)

(1) R: megafauna died as a result of loss of vegetation/habitat or had small SA:V ratio and could not adapt to the hotter conditions (Reason for change in Australian fauna.)

10. Biological evidence: fossils of plants such as *Glossopteris* and *Gangamopteris* are found only on Gondwana continents (1). Primitive marsupials of Australia have similar features in common with marsupials of South Africa.

(1): name of fossil (1): description of fossil – it is a plant

Note: must state that these fossils represent a plant (“describe”).

11. Leaves drop off when they have accumulated salt. (1): mangrove part involved; (1): how the part gets rid of salt in the plant.

12. (1): arrows point towards consumer (1) correct relations shown

13. (a) Pouch; young born immature. (1)

(b) (1) P: Placental mammals competed with marsupials in other continents and were more successful at surviving. Thus, marsupials died out in other continents.

(1) I: Marsupials became isolated in Australia once it split from Sth America. A small number of marsupials survived in Sth America due to its favourable environment (like Australia) and having adaptations that enable them to compete with the placental mammals there.