

2007

**PRELIMINARY COURSE
EXAMINATION**

BIOLOGY

General Instructions

- Reading time – 5 minutes
- Working time – 85 minutes
- Write using black or blue pen

- Draw diagrams using pencil
- Write your Student Exam Number on the Part A Answer Sheet (p. 16 of this booklet) and the Part B Question and Answer Book (pp. 5-15 of this booklet)

Total marks for this paper: 65

This paper has two parts, Part A and Part B

Part A

Total marks (10)

- Attempt all questions
- Allow about 12 minutes for this part

Part B

Total marks (55)

- Attempt all questions
- Allow about 73 minutes for this part

Part A

Total marks (10)

Attempt all questions

Each question is worth one mark

Allow about 12 minutes for this part

Select the alternative A, B, C or D that best answers the question and place an X, using ink, in the corresponding space in the table on your Part A Answer Sheet (p. 16 of this booklet).

1. The miracle tree in India, *L. leucocephala*, was so named because it is widely used for revegetation, soil and water conservation. Research has found that it contains a toxic, non-protein amino acid in its leaves that inhibits the growth of other trees but not its own seedlings. However, while *L. leucocephala* has been shown to reduce the yield of wheat, it has been able to increase the yield of rice.

The actions of *L. leucocephala* are an example of what type of interaction?

- (A) allelopathy
 - (B) mutualism
 - (C) symbiosis
 - (D) parasitism
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2. In which one of the following pairs would the two plants have the most characteristics in common?
 - (A) *Ehrharta longiflora* and *Epacris longiflora*
 - (B) *Epacris lanuginosa* and *Erica lusitanica*
 - (C) *Epacris longiflora* and *Erica longifolia*
 - (D) *Ehrharta distichophylla* and *Ehrharta longiflora*
 3. Most fossil remains are of aquatic rather than terrestrial organisms. Which one of the following is the best explanation for this?
 - (A) Aquatic organisms have more hard parts in their bodies than terrestrial organisms.
 - (B) Sedimentary rocks are not formed in a terrestrial environment.
 - (C) Dead terrestrial organisms are more likely to decompose than dead aquatic organisms.
 - (D) Dead aquatic organisms are more likely to become covered with sediments.

4. Under the binomial system of nomenclature, an organism was given the name *Oryctolagus cuniculus*. The first name, *Oryctolagus*, refers to its
- (A) phylum.
 - (B) species.
 - (C) genus.
 - (D) family.
5. This question refers to the diagram, which compares the number of differences in the nucleotides for a respiratory enzyme from different species of animals.

The Minimum Number of Nucleotide Differences Required to Account for the Differences in the Cytochrome *c* Molecules of 11 Organisms

ORGANISM	1	2	3	4	5	6	7	8	9	10	11
1. Human	—	1	13	17	16	13	12	12	17	16	18
2. Monkey		—	12	16	15	12	11	13	16	15	17
3. Dog			—	10	8	4	6	7	12	12	14
4. Horse				—	1	5	11	11	16	16	16
5. Donkey					—	4	10	12	15	15	15
6. Pig						—	6	7	13	13	13
7. Rabbit							—	7	10	8	11
8. Kangaroo								—	14	14	15
9. Duck									—	3	3
10. Pigeon										—	4
11. Chicken											—

According to this information, which two organisms are the least related?

- (A) humans and monkeys
 - (B) humans and chickens
 - (C) humans and pigeons
 - (D) monkeys and chickens
6. A tiny crab lives inside the shell of a large mussel. When food is scarce, the crab may feed on the tissues of the mussel, harming the mussel. What type of relationship is this?
- (A) mutualism
 - (B) commensalism
 - (C) parasitism
 - (D) predation

7. Assuming that all the producers have the same amount of energy and are of the same abundance, in which of the following food chains is the least amount of solar energy transferred to humans?
- (A) rice → human
 - (B) lucerne → steer → human
 - (C) phytoplankton → zooplankton → human
 - (D) grass → grasshopper → frog → trout → human
8. Which adaptation enables the grey mangrove to survive the relatively anoxic estuarine mud environment?
- (A) pneumatophores
 - (B) sunken stomates
 - (C) salt-secreting glands
 - (D) waxy cuticle
9. What is the order classification of the platypus?
- (A) marsupial
 - (B) monotreme
 - (C) placental mammal
 - (D) vertebrate
10. Which two adaptations enable the grey mangrove to survive an estuarine environment?
- (A) accumulation of salt in leaves until leaves drop off; secretion of salt through glands on the leaf
 - (B) sunken stomates; exclusion of salt from the roots
 - (C) salt-secreting glands; salt-accumulating glands
 - (D) waxy cuticle; sunken stomates

Part B

Total marks (55)

There are 14 questions in this part. Attempt all questions.

Marks vary for each question.

Answer the questions in the spaces provided in this Part B Question and Answer Book.

Write your Student Exam Number at the top of each page.

Allow about 72 minutes for this part.

Question 1 (6 marks)

Two American scientists, Urey and Miller, conducted a famous experiment during the late 1950s.

(a) State a hypothesis for the Urey-Miller experiment. (1 mark)

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(b) Describe one assumption these scientists made when designing their experiment. (1 mark)

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(c) Describe the implications this experiment had on our understanding of the origin of life. (2 marks)

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Question 3 (2 marks)

Describe two pieces of evidence that indicates that Australia was once part of an ancient super continent 'Gondwanaland'.

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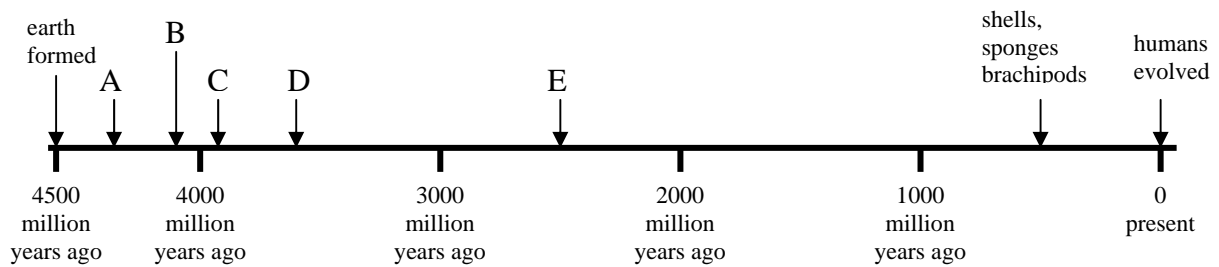
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Question 4 (5 marks)

The 5 major stages for the evolution of life are shown on the timeline below. Each stage is labelled A, B, C, D and E. Write the names of each stage in the appropriate box below the timeline.



A =

B =

C =

D =

E =

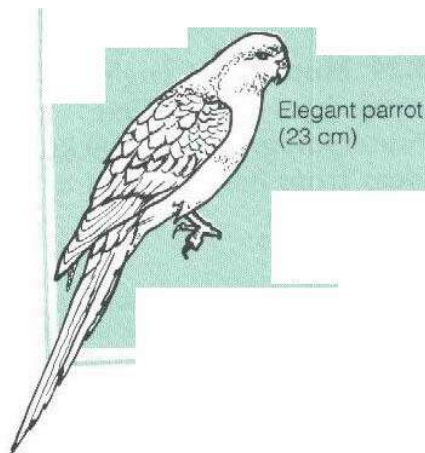
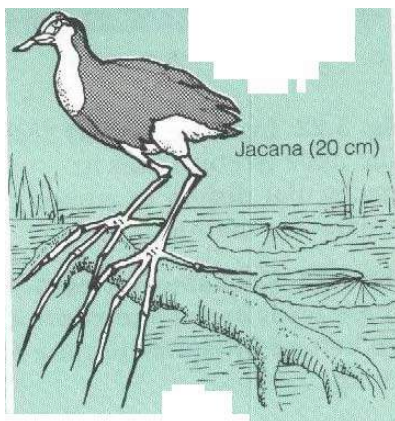
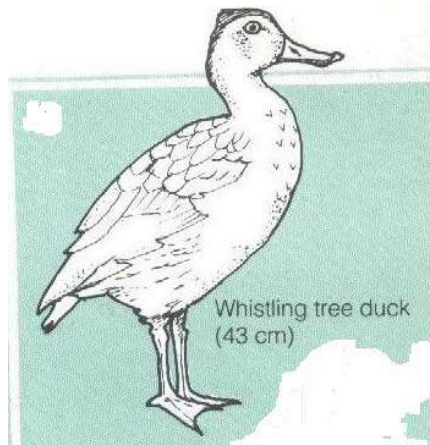
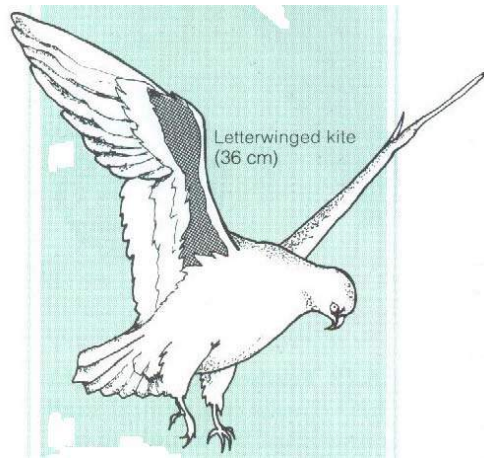
Question 6 (5 marks)

Complete the table below, which distinguishes the major procaryotic cell types.

Procaryotic cell	Role in ecosystem	Environment found
Eubacteria		Widespread habitats: land, water or host
Archaeobacteria	Carry out inorganic reactions for chemical energy	
Cyanobacteria		
Methanogens	Use hydrogen or hydrogen-rich compounds for energy; release methane	

Question 7 (3 marks)

This question refers to the following diagrams of Australian birds.



Construct a dichotomous key in order to key out each bird.

Question 8 (4 marks)

- (a) Describe one piece of palaeontological evidence that suggests when life originated on earth. (2 marks)

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- (b) Describe one piece of geological evidence that suggests when the first eucaryotic cells occurred on earth. (2 marks)

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Question 9 (3 marks)

- (a) Name an introduced species in Australia. (1 mark)

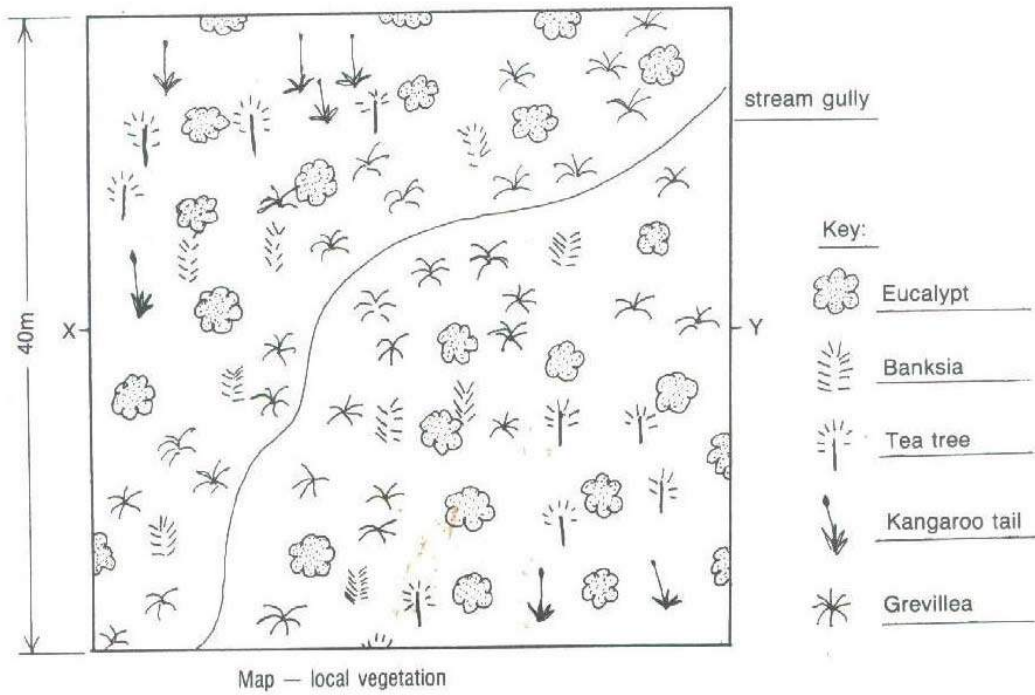
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- (b) Explain the impact the named species introduced has had on Australian ecology. (2 marks)

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Question 10 (4 marks)

A class of students studied a local ecosystem and compiled the map shown below.



(a) Draw the transect for X – Y. (2 marks)

(b) Describe how you would determine the abundance of Grevillea in this ecosystem using a sampling technique that you have learned in your course. (2 marks)

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Question 12 continued.

- (b) Explain why the fossil you have given in (a) is evidence for the hypothesis that present-day organisms have evolved from different organisms in the past. (2 marks)

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Question 13 (5 marks)

Consider the following the community:

Bears roam the forest by day and wolves roam the forest at night. Forest trees provide abundant food for rabbits in the form of nuts, fruits, leaves and twigs. However, the rabbits are not without competitors, for there are many leaf-eating insects and the squirrels survive on nuts and fruits. The birds of the area feed on the insects and insectivorous mice, while endeavouring to avoid their predators, the bears and wolves. The bears would have a lean diet indeed if they had to rely solely on the birds for prey, but they are very efficient at hunting squirrels. The introduction of the red fox to the area has provided a predator for the rabbit, but at the same time, has provided a new source of food for the wolves.

- (a) Construct the food web for this community. (3 marks)

- (b) What important group of organisms has been omitted from this description? (1 mark)

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Part A Answer Sheet (DO NOT DETACH)

Total marks (10)

There are 10 questions in this part. Attempt all questions.

Each question is worth one mark.

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

Allow about 12 minutes for this part.

Select the alternative A, B, C or D that best answers the question and, using ink, place an X in the corresponding space in the table below.

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

Rough work area

Preliminary Course Biology: Term 3 Examination 2007: Marking Guidelines

Part A

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

Part B

1. (a) The organic molecules needed for forming cells (1) were formed from the chemicals that composed the earth's early atmosphere. (1) (b) The early earth's atmosphere was composed of (CH₄, NH₃, H₂ and H₂O). (c) They subjected a mixture of gases (CH₄, NH₃, H₂ and H₂O) that were suppose to represent the primordial (early) earth atmosphere to electrical discharges, which represented the lightning of the early earth's atmosphere. The chemicals formed were similar to amino acids. (1) This finding suggests that the chemicals of life may have originated from the early earth's atmosphere. (1) (d) Panspermia theory (1): organic molecules on early earth were derived from outer space. (1)

2. Classification of procaryotes: Using biochemical technology it has been possible to sequence the amino acids and nucleic acids (DNA, RNA) of procaryotes. This revealed that the old classification of procaryotes as Kingdom Monera (eubacteria) had to be altered to cater for another group of procaryotes, the archaea bacteria. The archaea bacteria differed from the eubacteria on the basis of their RNA sequences and the chemicals used to make their cell wall.

(1): original classification

(1): recent classification

(1): technology used (biochemical analysis of ssribosomal RNA, sugars in cell wall (murein))

3. Continental margins of continents such as Australia, India and Antartica match. (1) Matching rock types of the same geologic age are found throughout Gondwana continents (tillites, dolerites) including Australia. (1) Fossils of plants such as *Glossopteris* and *Gangamopteris* are found only on Gondwana continents. Primitive marsupials of Australia have features in common with marsupial of South Africa.

4. A = organic molecules (1); B = formation of membranes (1); C = heterotrophic prokaryotes (or protenoids) (1); D = autotrophic prokaryotes (1); E = eukaryotes (1)

5. Modern kangaroo (extant): research about the type of ancestors of the modern kangaroo is ongoing. For example, fossils at Riversleigh show that the bulungamyines rather than the balbarines are the ancestors of the modern kangaroo. The shapes of the skull bones and molars (teeth) of the bulungamyines are more similar to the modern kangaroo than those of the balbarines. Bulungamyine fossils are more common in the younger rocks than the balbarines.

A: balbarines

B: bulungamyines

E: evidence (skull bones)

E: evidence (teeth)

6.

Prokaryotic cell	Role in ecosystem	Environment found
Eubacteria	Decomposers (1)	Widespread habitats: land, water or host
Archaeobacteria	Carry out inorganic reactions for chemical energy	extreme environments (deep sea vents, deep soil) (1)
Cyanobacteria	convert nitrogen into ammonia and NH_4^+ (nitrogen cycle), produce oxygen (1)	Aquatic or terrestrial (1)
Methanogens	Use hydrogen or hydrogen-rich compounds for energy; release methane	Bogs, deep soils, sewage treatment, intestinal tract (1)

7. webbed feet (duck)/no webbed feet (others) → feet longer than legs (Jacana)/feet not longer than legs (others) → less than 30 cm (parrot)/greater than 30cm (kite).

(1): dichotomous key (yes/no)

(1): distinguishing features for two organisms correctly

(1): distinguishing all four organisms using unambiguous classification features

8. (a) Chert fossils (1) (microfossils) are approximately 3.5 bya (1). These fossils are of a bacterium.

(b) Iron oxide banding in rocks (1) are evidence of oxygen being formed from aerobic forming cells (eukaryotes) (1).

9. (a) Cane toad (1) (b) Poison native predators (1). Increase competition for resources with native organisms. (1)

10. (a) (1): cross-section shown. (1): slope shown in correct location.

(b) (1): quadrant sampling (1): 4 x 4m – 10 x 10m

11. Chloroplasts and mitochondria have their own DNA. This demonstrates that these organelles may have once been prokaryotes. Chloroplasts and mitochondria have a double membrane structure. This suggests that a smaller prokaryote was engulfed by a larger prokaryote. The larger prokaryote provided some form of protection for the engulfed cell which may have yielded energy-rich compounds or proteins for the larger cell. These relations represent symbiosis.

(1) S: symbiosis understanding

(1) D: chloroplasts and mitochondria contain DNA

(1) M: chloroplasts and mitochondria have a double membrane

(1) E: engulfed

12. (a) Archaeopteryx, trilobite, lobe-fin fish (1)

(b) Archaeopteryx has features of birds (shoulder girdle, feathers) and reptiles (scales, teeth, tail bone) thus demonstrating the evolutionary step from reptiles to birds. Lobe-fin fish had the features of a fish (gills, scales, fins) and amphibians (lobe-fins, air bladder) thus demonstrating the evolutionary step from fish to amphibians. Trilobites had similar features to giant horseshoe crabs (body shell, pointed tail, jointed legs). This suggests that crabs evolved from trilobite organisms.

13. (a) (-1): incorrect arrows (-1): incorrect sequence (-1): incorrect sequence

(b) decomposers (c) wolves or bears or birds

14.

3-kingdom classification scheme (plants, animals, monera)

Advantages: distinguishes prokaryotes from eukaryotes

Disadvantages: does not account for fungi and the different types of bacteria and protists

5-kingdom classification (plants, animals, monera, protists, fungi)

Advantages: classifies the five cell types

Disadvantages: does not take into account the archaeobacteria and eubacteria (monera) classification of prokaryotes. Needs a microscope to classify cells.

(1): advantage

(1): disadvantage

(1): advantage

(1): disadvantage