MARKING KEY

SECTION ONE—MULTIPLE CHOICE

Questions 1–10

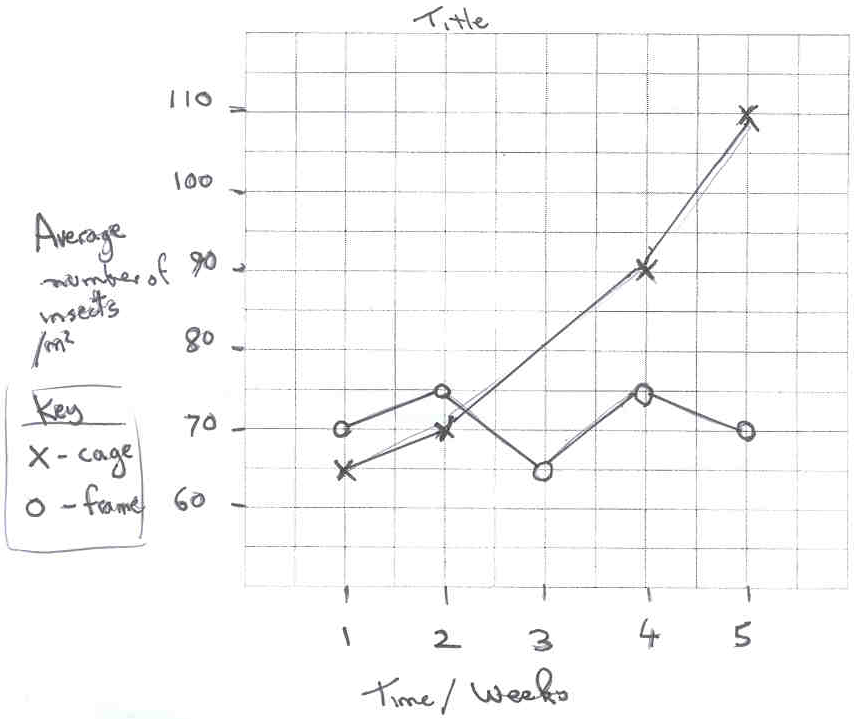
1	C
2	D
3	C
4	B
5	B
6	C
7	B
8	D
9	A
10	A

SECTION TWO—SHORT ANSWERS

QUESTIONS 1–9

Question 1 ***[20 marks]***

(a) Graph



1	Title/heading
1	Correct axis labelled including units
1	Appropriate scale and accurate plotting
1	Key

(b) Use the graph to predict likely values for these readings had it been possible to measure them.

(i)

1	Frames Week 6: 70/average or 65-75 insects
1	Cages Week 3: 80

(ii) In which prediction do you have greatest confidence? Explain why.

1	Cages week 3
1	lost data is between two plotted points (interpolation is more reliable than extrapolation)

(c) The students' original hypothesis was that predation by the fish decreased the numbers of insects on the stream bed. Do the experimental results support the hypothesis? Explain your answer by referring to the data collected and to the design of the experiment.

	Yes because:	OR	No because:
2	Data: trend of graph (insects increase as fish excluded)		No decrease in presence of fish
2	Design: control, sample size, time		Larger sample size needed, longer time

(d) (i) What is the control for this experiment?

1	Frames

(ii) Why is the control needed?

1	Compare with mesh cage (no fish)

(iii) Give two reasons why the students did not use just one cage and just one wire frame.

1	Large sample size more reliable.
1	Reduces chance results.

(e) (i)

1	dependent variable: number of insects

(ii)

1	independent variable: presence/absence of fish

(f) A student complained that the experiment was flawed because there was at least one uncontrolled variable. Name one uncontrolled variable and say why it is important.

2	Light	Mesh may shade more than the wire frame.
	or food	Mesh may trap food.
	or predation	Other predators not considered.
	or turbulance	Affected by mesh.

Question 2 ***[10 marks]***

[From: Board of Studies New South Wales, 1996]

a) Explain why coleoptile X bends more than coleoptile Y.

1	Block 1 contains more auxin than block 2.
1	Block 1 had more auxin because it was under the part of tip away from sunlight.
1	Auxin moves from the agar block into seedling X.
1	X bends more than Y because block 2 had less auxin

b) Describe what happens to the cells in the stem of coleoptile X at point A on the diagram.

1	The cells at point A undergo elongation
1	Cells elongate under the influence of growth hormone/auxin.

c) Name the plant response being investigated in this experiment.

1	Phototropism

d) State three advantages of this response to growing plants?

1	Allows plants to grow towards sunlight.
1	Allows immobile plants to change direction to gain maximum light.
1	Advantage as plants require sunlight for photosynthesis.

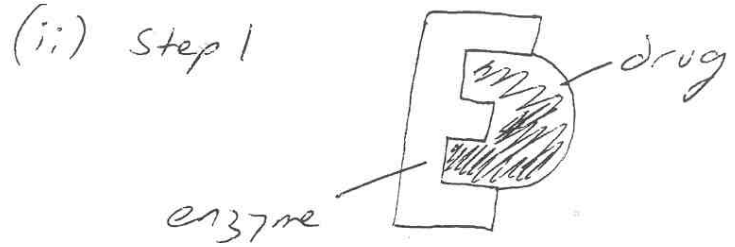
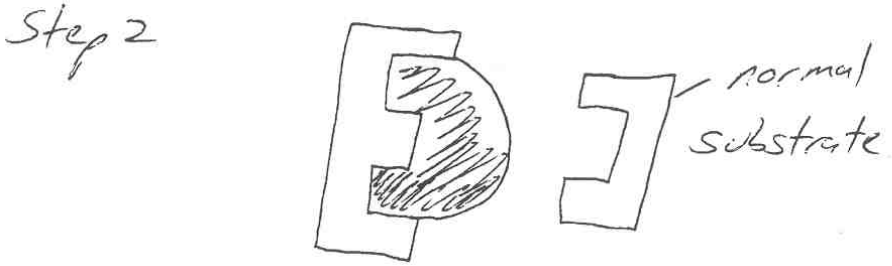
Question 3 ***[14 marks]***

[From: Board of Studies New South Wales, 1997]

(a) How does this model explain the idea of enzyme specificity?

1	A particular enzyme catalyses one substrate only.
1	This is demonstrated by using matching shapes to represent specific nature of enzymes

(b) Some drugs are effective in killing parasites because they block enzymes involved in biochemical pathways critical for the growth of the organism. Using a diagram similar to that above, illustrate and explain how these drug molecules could block the enzyme involved.

1	 or similar
1	 or similar
1	The drug binds to the enzyme's active site.
1	Normal substrate unable to bind with enzyme.
1	Enzyme action blocked and substrate not metabolised.

(c) The enzyme amalyse, which is found in saliva, promotes the breakdown of starch to maltose. If saliva is mixed with starch, eventually all the starch will be broken down regardless of the amount of saliva added. Explain why this occurs.

1	Enzymes are not used up in the reaction
1	Enzymes remain chemically unchanged after catalysing the substrate (starch)
1	Enzymes can be re-used until substrate is used up

d) Food containing starch is mixed with saliva in the mouth and the starch begins to break down due to the action of the amylase. Suggest what may happen to this rate of reaction when the food enters the stomach.

1	Rate of reaction would decrease
1	Enzyme action is affected by the pH of their environment
1	Lower pH in stomach than mouth due to presence of acid
1	Amylase denatured

Question 4 ***[16 marks]***

[From: Board of Studies New South Wales, 1996]

(a) (i) Name the process summarized in the diagram.

1	photosynthesis

(ii) Where in the chloroplast does the light reaction occur?

1	Within the grana of the chloroplast

(iii) Name the compounds X, Y, Z in the above diagram.

1	X: water
1	Y: glucose (6 carbon sugar)
1	Z: carbon dioxide

(iv) Plants sometimes have been called 'energy converters'. Briefly discuss this statement.

1	Plants able to trap light energy (using chlorophyll).
1	Plants able to convert light energy into chemical (stored) energy.
1	Convert inorganic molecules into complex organic where energy is stored in the bonds

(b) Below are word equations that describe two forms of respiration.

I sugar → lactic acid + energy

II sugar + oxygen → water + carbon dioxide + energy

(i) Name the two forms of respiration.

1	I: anaerobic respiration.
1	II: aerobic respiration.

(ii) Name and briefly outline one biochemical pathway which is common to both forms of respiration.

1	Glycolysis ("sugar breakdown')
1	Sugar (glucose) is chemically broken down into a simpler product (pyruvate)

(iii) State how many molecules of ATP are produced by each of the two forms of respiration.

1	I. 2 molecules of ATP.
1	II. 36 molecules of ATP (38 in heart, liver, kidneys).

(iv) Name the site(s) in the cell where processes I and II take place.

1	I. outer membrane
1	II. inner folded membrane

Question 5 ***[10 marks]***

[From: Board of Studies New South Wales, 2000]

(a) Comment on the distribution of the introduced species and native Australian plants.

1	Introduced species spread along water edge.
1	Native plants are growing further back from the water edge.

(b) Give **two** possible reasons for the observed distribution of introduced species and native Australian plants.

1	Human impact: open drain creates ideal conditions for introduced species.
1	Competition: introduced species rapid growth/spread in ideal conditions

(c) Suggest **four** possible methods for managing and/or eradicating the introduced species.

1	Spray affected areas with herbicide
1	Removal of introduced species by hand
1	Introduce specific biological control species after extensive research
1	Controlled burning and replanting native species

(d) Briefly describe the likely changes over time and/or possible impacts on the fauna and flora if no steps were taken to control or manage the introduced species.

1	Native species would decline in numbers.
1	Fauna affected if used native plants as food source or shelter.

Question 6 ***[16 marks]***

(This question is common to the stage two sample examination.)

(a) (i) Name two possible sources of excess nutrients in the Peel Inlet.

1	Fertilisers from agricultural and domestic sources
1	Sewage from domestic leach tanks

(ii) Name two possible causes of water turbidity in the Peel Inlet.

1	Boating activity
1	Strong winds

(b) (i) Briefly explain two ways the turbidity could affect the population of macro algae.

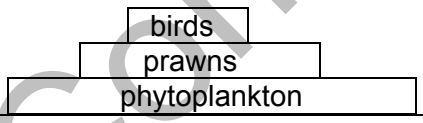
1	Reduced light reaching plants reduces photosynthesis
1	Oxygen levels reduced.

(ii) Explain briefly how the turbidity would affect the populations of commercially important species such as larger fish, crabs and prawns.

1	Producers are food for the consumers and therefore support the food web.
1	Number of producers reduced will also reduce consumer populations.

(c) (i) Draw a biomass pyramid for the following food chain.

Phytoplankton ------- prawns -------- waterbirds

1	Drawing: 
1	Labelling

(ii) Briefly explain how the insecticide becomes more concentrated in each higher level of the food pyramid.

1	Insecticide transferred to predator (next organism in the food chain).
1	Insecticide accumulates as predator consumes many of its prey.

(iii) Give **two** reasons why spraying insecticide is bad for the ecosystem. Briefly explain your answers.

1	Non-specific: affects all insects including those that are beneficial.
1	Affects the food web: insects

(iv) Suggest two methods, besides spraying, which could help reduce the mosquito population.

1	Release sterile mosquitoes into the population.
1	Increase natural predators/introduce disease or predator

Question 7 ***[15 marks]***

(a)

1	A: hydrogen bond(s)
1	B: base
1	C: sugar (pentose)
1	D: phosphate

(b) (i) State the purpose of DNA replication.

1	To produce new molecules/copy of existing DNA with the same base sequence.
1	So that the hereditary information it contains is passed on to the next generaration.

(ii) Explain, using DNA as an example, what is meant by the base pairing rule.

1	In DNA there are four bases: adenine (A), thymine (T), cytosine (C), guanine (G).
1	The bases form complementary pairs.
1	A only pairs with T as these bases have two hydrogen bonds and complement each other. G only pairs with C as these two bases have three hydrogen bonds and complement each other.
1	The bases pair up in this way to link two strands of nucleotides and form DNA.

(iii) DNA replication is known as semi-conservative. What does 'semi-conservative' mean in terms of DNA replication.

1	Each of the two new molecules/copies consist of one old strand from the 'parent' molecule and one new strand.
1	The replicated DNA has one original (conservative) strand and one newly synthesised strand. Hence semi-conservative.

(iv) Write down the base sequence of the original DNA segment in the space provided.

1	C A T T A C G (same as original segment) G T A A T G C

(v) Certain enzymes, generally termed nucleases, are associated with DNA. These enzymes are involved in the synthesis, binding and break up of DNA. Would nucleases taken from one species work on the DNA of an entirely unrelated species? Explain your answer.

1	Yes. The enzymes in one species can be used to work on the DNA of other species.
1	This is because the structure of DNA is the same for all species.

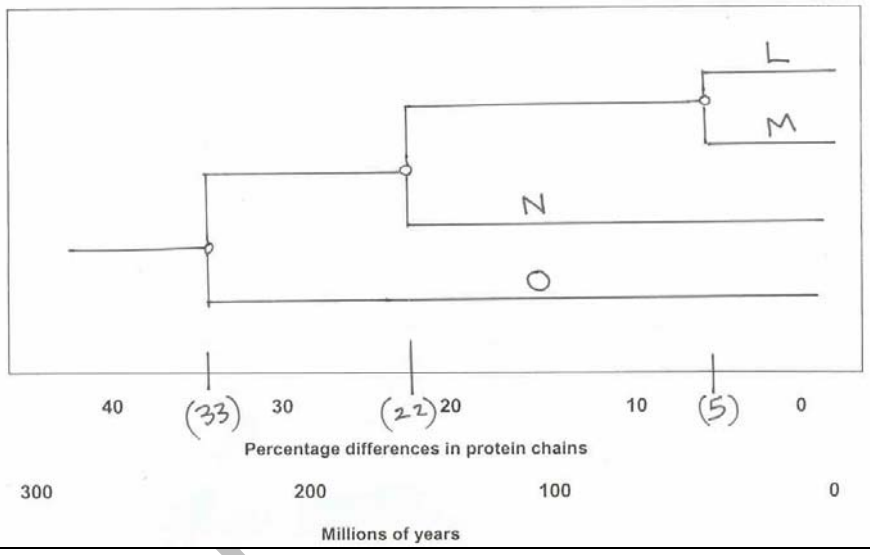
Question 8 ***[14 marks]***

(a) Compared to the gibbon would you expect percentage differences in the amino acid sequence of platypus haemoglobin to be more or less than that of the elephant? Explain your answer.

1	More.
1	Elephant is more closely related to the gibbon than the platypus (marsupial).
1	More percentage difference indicates more distantly related.

(b) Using the information below, draw an hypothetical evolutionary relationship for the species L, M, N and O in the space provided. Show all workings.

% differences in protein chains			
Species	M	N	O
L	5	24	35
M		20	30
N			34

1	Average percentage difference: 5 22 33
3	

(c) In the study of evolutionary relationships what is meant by the term 'common ancestor'?

1	A species that existed previously and has evolved into different species.
1	Ancestor shared by two or more later (evolutionary related) species.

(d) Use your drawing from (b) to answer the following questions.

(i) Could species M have evolved from species L? Give a reason for your answer.

1	No.
1	L and M have co-existed for approximately 50 million years.

(ii) Approximately when, in mya, did species N first appear?

1	150 mya

(iii) Is species N the common ancestor of species L and species M? Explain your answer.

1	No.
1	Species N appeared 100 mya earlier but co-exists with species L and M.

Question 9 ***[15 marks]***

(a)

	Steps	Required technique or 'tool'
1	Extraction of DNA from cells	precipitation
1	Cut DNA into specific fragments	restrictive enzyme
1	Arrange DNA fragments by length	electrophoresis
1	Locate particular DNA fragment	probe
1	Joining of DNA fragments	ligase
1	Transporting DNA fragment into a cell	Vector
1	Producing multiple copies	cloning

(b) Define the term recombinant DNA.

1	Recombinant DNA is DNA that has been recombined from different origins.
1	.DNA molecules composed of fragments from different sources and joined together.

(c) Could the same techniques or tools be used on all genetic material regardless of its source? Explain your answer.

1	Yes
1	This is possible because the structure of DNA is the same for all species.

(d) Briefly describe two applications of recombinant DNA technology.

1	The production of specific proteins, e.g. insulin, using bacterium which then multiple to form a large population from which insulin can be extracted.
1	Development of GM foods e.g. varieties of tomato with a longer shelf life.
1	Production of: vaccine, anticoagulants, interferon.
1	Bioremediation: bacteria used to breakdown pollutants.

SECTION THREE—EXTENDED RESPONSE

QUESTIONS 10–11

Question 10 ***[20 marks]***

(a) Using a named example of natural selection in action, explain how **one** selective force in the environment contributes to an evolutionary change.

1	Example describing variation e.g. peppered moth colour change. Two forms/variations: light colour and dark colour Other possible examples: Cane toad leg length Antibiotic resistant bacteria Viral resistance in rabbits Pesticide resistance (DDT)
1	Variation in population (from mutation and meiosis)
1	Variation inherited/genetic
1	Name selective force e.g. predation
1	How gene pool changes (environment provides the selective force) e.g. selective force/pressure alters gene frequency by targeting light forms in polluted areas.
1	Dark/favoured forms more likely to survive to maturity and reproduce.
1	Genes passed on to next generation.
1	Dark/favoured form allele increases in population (shift in gene frequency over many generations).
1	Best adapted tend to survive to reproduce (survival of the fittest) e.g. increase in dark colour forms in the population over several generations.
1	Evolutionary change/Speciation

(b) Terrestrial organisms need to maintain water balance to survive. Using a named plant example and a named animal example, briefly describe **four** adaptations for each example that allow each kind of organism to gain or conserve water in their natural environment.

1	Named animal example (any suitable example that matches adaptation) e.g. Desert hopping mouse
	Animal adaptations (any **four** briefly described):
1	Gain: Drinking
1	Physiological e.g. from metabolism e.g. from food
1	Conserve: Behavourial e.g. nocturnal avoid heat of day. e.g. burrow cooler than surface temperature.
1	Structural e.g. large vascular ears.
1	Named plant example (any suitable example that matches adaptation) e.g. Mulga
	Plant adaptations (any **four** briefly described):
1	Gain: Branches spread form trunk to channel rain water
1	Extensive root system (osmosis)
1	Conserve: Reduced number of stomata reduce transpiration rate
1	Stomata shorter opening time/closed during heat of day

Question 11 ***[30 marks]***

(a) (i) Describe what information is conveyed by food webs in general and by this particular food web.

	In general:
1	feeding relationship between populations of organisms in a community or ecosystem.
1	energy transfer between populations of organisms within a community or ecosystem.
1	consist of many linked food chains.
1	divisions/trophic structure: producers, primary consumers, secondary etc.
1	four types of generalised producers/autotrophs.
1	relationships (predator/prey) between heterotrophs/comsumers.
1	competition: between top consumers e.g. for trout.

ii) Describe briefly any other useful items of information that may have been omitted or oversimplified for this food web and predict what may happen if the trout population is completely removed from the community?

1	decomposers omitted from all levels.
1	some organisms omitted such as additional producers and consumers
1	some links/food chains omitted.
1	migratory animals omitted.
1	general categories used instead of named species.
1	trout removed: less food for top consumers such as heron and eagle.
1	: increase in minnows and copepods.
1	: less food and increased predation may reduce bream population.

(b) A year 12 student sows 100 seeds of a plant species on a single garden bed. While the plants are growing, the student notices that 20 plants growing in one part of the garden bed are not as tall as the rest of the plants.

(i) Name five factors that may have caused the differences in size between the two groups of plants.

	Environmental
1	more shade in area where plants not tall.
1	contamination of soil in that part of garden.
1	disease/predation affecting growth.
	Genetic
1	no gene for tallness however expect shorter plants to be spread through garden bed and not concentrated in one area. Also numbers (one fifth) do not fit expected Mendalian ratios of 3:1.
	Combination
1	combination of genetic and environmental where factor (unknown) is switching off gene(s) for tallness.

(ii) Design an experiment that will provide convincing evidence to the world community of scientists that the student could carry out to determine whether one of the factors you named in part (i) is responsible for the reduced size of the group of 20 plants.

1	Plan/design outline including stated hypothesis.
1	Aim e.g. test soil for contamination.
1	control
1	Independent variable
1	Dependent variable
1	Controlled variables
1	method
1	Collected data and results
1	Conclusion/presentation of data.
1	Repeat following year using same plant species and seed source.

ACKNOWLEDGEMENTS

SECTION TWO

Question 12

Adapted from: Board of Studies New South Wales. (1996). *1996 Biology 2 Unit: Higher School Certificate Examination* (p. 22). Retrieved August, 2007, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/96BIOLGY.PDF.

Question 13

Board of Studies New South Wales. (1997). *1997 Biology 2 Unit: Higher School Certificate Examination* (p. 17, q. 33(d)). Retrieved August, 2007, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/97BIOLGY.PDF.

Question 14

Adapted from: Board of Studies New South Wales. (1996). *1996 Biology 2 Unit: Higher School Certificate Examination* (p. 17). Retrieved August, 2007, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/96BIOLGY.PDF.

Question 15

Adapted from: Board of Studies New South Wales. (2000). *2000 Biology 2 Unit: Higher School Certificate Examination* (p. 43). Retrieved August, 2007, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/00biology.pdf.

Biology
Sample external written examination
Stage 3
Mapping questions to content

Course content	*Ecosystems: biodiversity and sustainability*	*Continuty of species*	**The functioning organism**	Working as a Biologist
Section One- multiple choice				
Question				
1			√	
2			√	
3	√			
4		√		
5		√		
6			√	
7			√	
8		√		
9		√		
10		√		
Section Two - short answers				
1				√
2*				
3			√	
4*				
5	√			
6	√			
7		√		
8		√		
9		√		
Section Three – extended response				
10		√	√	
11	√	√	√	√

*****Section two: Question 2 and question 4 referred to 'old content' and have been struck through in the Stage three sample exam (185723.doc).
These questions will be replaced after the 'under construction' Stage three sample exam is presented for consultation at the 15th October PD.