



Government of Western Australia
School Curriculum and Standards Authority



Western Australian Certificate of Education Examination, 2013

Question/Answer Booklet

BIOLOGICAL SCIENCES Stage 3

Please place your student identification label in this box

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Number of additional
answer booklets used
(if applicable):

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in the WACE examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.



Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	30	30	40	30	30
Section Two: Short answer	5	5	90	100	50
Section Three: Extended answer Part A	3	2	50	40	20
Part B	3	2			
Total					100

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2013*. Sitting this examination implies that you agree to abide by these rules.
- Answer the questions according to the following instructions.

Section One: Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in the spaces provided in this Question/Answer Booklet. Wherever possible, confine your answers to the line spaces provided. Use a black or blue pen (not pencil) for this section. Only the graph may be drawn in pencil.

Section Three consists of two parts each with three questions. You must answer **two** questions from **each** part. Tick the box next to the question you are answering. Do **not** copy the questions when answering. Answers could be presented in a variety of ways: using clearly labelled tables and graphs or diagrams with explanatory notes, writing lists of points with linking sentences and drawing annotated flow diagrams with introductory notes.

- You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

See next page

Section One: Multiple-choice

30% (30 Marks)

This section has **30** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

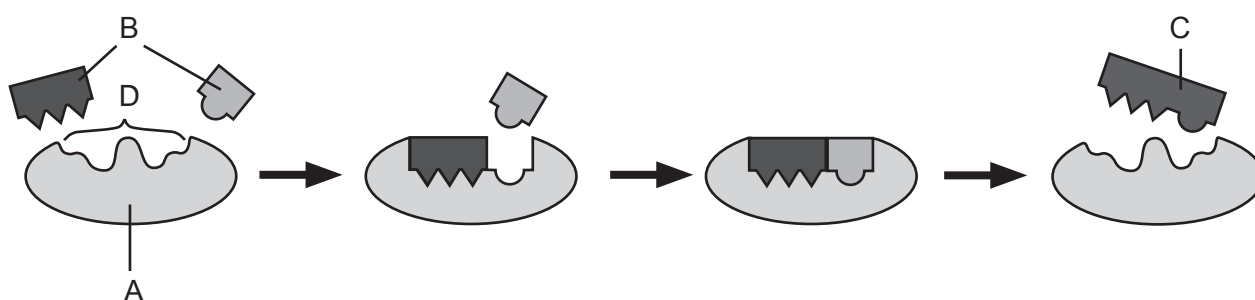
1. If plants are placed in visible light of different wavelengths in controlled conditions they will
- (a) vary in the rate of respiration.
 - (b) produce different amounts of glucose.
 - (c) produce O₂ at a constant rate.
 - (d) lose different amounts of water.

2. Which of the following comparisons concerning freshwater and marine fish is correct?

	Freshwater Fish	Marine Fish
(a)	Large quantities of urine	Small quantities of urine
(b)	Concentrated urine	Dilute urine
(c)	Gain water through gills	Gain ions through gills
(d)	Actively drink water	Don't drink water

3. Reptiles can survive without food for much longer periods of time than mammals. The main reason for this is that
- (a) reptiles produce uric acid as an excretory product.
 - (b) mammals are endothermic and reptiles are ectothermic.
 - (c) reptiles are able to eat more food at any one time than mammals.
 - (d) mammals generally have a larger body size than reptiles.

Questions 4, 5 and 6 refer to the diagram below, which shows a model of enzyme action.



4. Which model of enzyme action is shown in this diagram?
- lock and key, with Structure A representing the enzyme
 - lock and key, with Structure C representing the enzyme
 - induced fit, with Structure A representing the enzyme
 - induced fit, with Structure C representing the enzyme
5. The model illustrates that enzymes
- consist of amino acids that join to form proteins.
 - change the level of energy required for a reaction.
 - are able to reverse the reaction to recover the substrate.
 - remain unchanged after the reactions they catalyse.
6. Which of the following is correct for enzyme action?
- An increase in temperature causes the shape of D to become distorted.
 - A decrease in pH causes B to change its chemical composition.
 - An increase in pH results in a substance different from C being produced.
 - An increase in temperature causes a lowering of activation energy for A.

The information below refers to Questions 7 and 8.

The table shows the surface area and volume of four cells of different sizes.

Cell	Surface area (mm ²)	Volume (mm ³)
1	1.70	0.135
2	0.54	0.027
3	1.50	0.125
4	0.06	0.001

7. The cell that has the greatest surface area to volume ratio is
- (a) cell 1.
 - (b) cell 2.
 - (c) cell 3.
 - (d) cell 4.
8. The diffusion of substances would be least efficient into
- (a) cell 1.
 - (b) cell 2.
 - (c) cell 3.
 - (d) cell 4.
9. DDT is an insecticide that has been banned in most countries for many years. However, it was used in the past in agriculture and to control disease-carrying mosquitoes. The chemical often leaked into waterways and was found at very high levels in predatory birds, such as pelicans, that fed on large fish. Levels of DDT were so high that the birds' eggshells became abnormally thin and the reproductive rate of pelicans declined.
- This effect on the pelicans was due to
- (a) increased salinity in the waterways.
 - (b) biomagnification of DDT through the food web.
 - (c) overpopulation of pelicans in the DDT affected areas.
 - (d) DDT killing the producers that supported the food web.
10. Which of the following would be a physiological adaptation by an endotherm in a cold environment?
- (a) vasodilation of skin arterioles to decrease heat loss by radiation
 - (b) counter-current heat exchange to reduce heat loss from extremities
 - (c) large amounts of fat under the skin to insulate from heat loss
 - (d) huddling to reduce the amount of surface area exposed to the environment

11. Which of the following is true of a negative feedback homeostatic mechanism?

The response

- (a) alters the original stimulus.
- (b) only occurs when there is a strong stimulus.
- (c) is carried out by receptors.
- (d) is always of the same intensity.

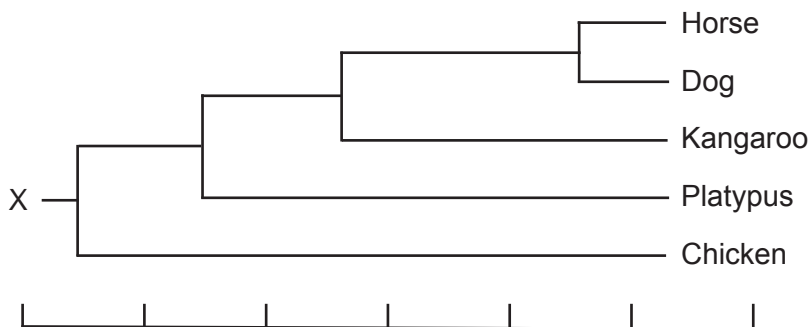
12. The developing embryos of egg-laying vertebrates, such as birds and reptiles, excrete nitrogenous wastes in the form of uric acid rather than urea or ammonia. The main reason for this is that uric acid

- (a) requires less water to remove it from the egg.
- (b) can be produced using less energy.
- (c) is less toxic to the embryo.
- (d) can easily diffuse from the egg.

13. The main cause of eutrophication in aquatic environments is

- (a) a lack of oxygen.
- (b) too much aquatic plant growth.
- (c) excess mineral nutrients.
- (d) high water temperature.

Questions 14 and 15 refer to the phylogenetic tree below.



14. What does X represent?

- (a) the ancestor of birds but not mammals
- (b) the oldest known fossil vertebrate
- (c) the very first mammal to evolve
- (d) the common ancestor of all five named animals

15. The label for the scale at the bottom of the phylogenetic tree should be

- (a) 'Time before the present'.
- (b) 'Rate of natural selection'.
- (c) 'Number of species'.
- (d) 'Classification level'.

See next page

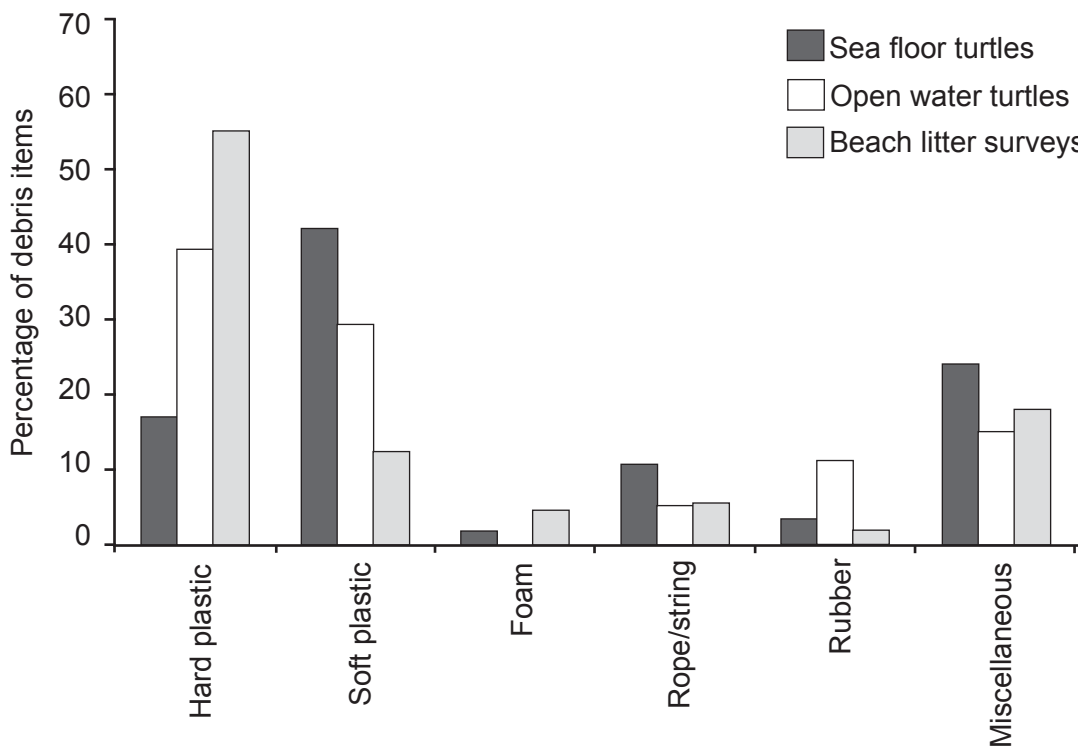
16. Which of the following occurs during protein synthesis?
- (a) RNA molecules are converted to DNA molecules.
 - (b) Ligase unwinds DNA molecules.
 - (c) Restriction enzymes cut DNA molecules.
 - (d) RNA polymerase binds to DNA molecules.
17. In which order do the three stages of polymerase chain reaction (PCR) occur?
- (a) annealing, denaturation, extension
 - (b) denaturation, annealing, extension
 - (c) extension, annealing, denaturation
 - (d) annealing, extension, denaturation
18. In gel electrophoresis
- (a) positively charged DNA fragments move toward the negatively charged electrode.
 - (b) large DNA fragments move more rapidly than small DNA fragments because they have a greater electrical charge.
 - (c) the gel is porous and acts like a sieve, allowing some fragments to pass through the pores more easily than others.
 - (d) the DNA fragments are mixed evenly with the gel material before it solidifies.
19. Some strains of disease-causing bacteria have evolved resistance to the antibiotics that were once used to treat the disease. This evolution has been driven by
- (a) artificial selection.
 - (b) natural selection.
 - (c) genetic drift.
 - (d) genetic engineering.
20. Which of the following is a transgenic organism?
- (a) a bacterium that has been modified to produce human insulin
 - (b) a mule that is a cross between a donkey and a horse
 - (c) an alga that has been introduced into an area in which it did not previously exist
 - (d) a mosquito with two pesticide resistant alleles at a gene

21. Scientists have determined that a huge number of species became extinct about 250 million years ago. Which of the following types of evidence would they have used to determine this?
- (a) biochemical
 - (b) embryological
 - (c) fossil
 - (d) genetic
22. Which of the following techniques can be used to study the activity of many genes at the same time?
- (a) gel electrophoresis
 - (b) polymerase chain reaction
 - (c) gene cloning
 - (d) DNA microarrays

Questions 23–25 refer to the information and graph below.

Sea turtles often ingest plastic and other debris that can kill them. The graph below shows the amounts of different types of debris found in the intestines of 11 open water turtles, 22 sea floor turtles and in 25 beach litter surveys. The data are reported as averages of the percentages of each type of debris found within each animal and in each beach litter survey. For example, on average, approximately 55% of the debris found in the 25 beach litter surveys was hard plastic.

Debris types found in turtles and on beaches



See next page

23. On average, approximately what percentage of the debris found in the intestines of open water turtles was soft plastic?
- (a) 43
 - (b) 39
 - (c) 30
 - (d) 12
24. Which of the following statements about the data in the graph is **most** accurate?
- (a) Foam was found in the intestines of sea floor turtles but not in the intestines of open water turtles.
 - (b) Hard plastic was the most common type of debris in the intestines of open water turtles and sea floor turtles.
 - (c) About the same percentage of rubber was found in the intestines of open water turtles and sea floor turtles.
 - (d) There was a higher percentage of miscellaneous debris in the beach litter surveys than in the intestines of sea floor turtles.
25. Assuming that the composition of the debris in the beach litter surveys was about the same as the composition of the debris on the sea floor where turtles had been feeding, the data in the graph suggest that sea floor turtles actively avoid ingesting
- (a) rubber.
 - (b) soft plastic.
 - (c) rope.
 - (d) hard plastic.
26. Which of the following is **not** associated with increased CO₂ levels in the earth's atmosphere?
- (a) global warming
 - (b) depletion of the ozone layer
 - (c) rising sea levels
 - (d) changing weather patterns

Questions 27 and 28 refer to the information below.

Scientists studying a Western Australian tuart forest (*Eucalyptus gomphocephala*) carried out an experiment to determine the ability of tuart trees to grow in burnt areas after bush fires. They measured the average heights and survival rates of tuart seedlings in burnt and unburnt areas.

27. The purpose of measuring height and survival rate in unburnt areas was to
- (a) act as a control procedure in the experiment.
 - (b) improve the reliability and accuracy of the experiment.
 - (c) ensure that a larger number of seedlings was examined.
 - (d) ensure that all variables in the experiment were controlled.
28. The independent variable in this experiment was
- (a) the height of the seedlings.
 - (b) the survival rate of the seedlings.
 - (c) burnt and unburnt areas.
 - (d) the choice of tuart trees for the study.
29. Which of the following statements about ecosystems is true?
- (a) Urban ecosystems have high inputs and low outputs.
 - (b) Natural ecosystems have lower productivity than urban ecosystems.
 - (c) There is no recycling in urban ecosystems.
 - (d) Agricultural ecosystems have less diversity than natural ecosystems.
30. All of the following can be recycled in an ecosystem except
- (a) energy.
 - (b) carbon dioxide.
 - (c) organic matter.
 - (d) inorganic matter.

End of Section One

See next page

Section Two: Short answer

50% (100 Marks)

This section has **five (5)** questions. Answer **all** questions. Write your answers in the spaces provided in this Question/Answer Booklet. Wherever possible, confine your answers to the line spaces provided. Use a blue or black pen for this section. Only the graph may be drawn in pencil.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 31

(20 marks)

- (a) Describe the relationship between DNA, genes and chromosomes. (3 marks)

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Question 31 (continued)

Parts (b) and (c) refer to the table below. It provides data on the number of chromosomes, amount of DNA and amount of time taken for meiosis to occur in germ cells of selected plant and animal species.

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- (b) (i) The data in the table indicate that germ cells with larger chromosome numbers do not necessarily contain more DNA. Provide a possible reason for this. (1 mark)

- (ii) What do the data in the table suggest about the relationship between the amount of DNA in a germ cell and the duration of meiosis in the plant species? (2 marks)

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- (c) (i) The data in the table suggest that the duration of meiosis might be slower in animals than plants. What aspects of the data suggest this? Quote data from the table to support your answer. (3 marks)

- (ii) Despite your answer above, the data in the table do not allow for reliable conclusions to be drawn about the relative duration of meiosis in plant and animal species. Give **two** possible reasons for this. (2 marks)

- (d) Evolution, at the species level, is driven by a small number of processes.

Name the evolutionary process that produces

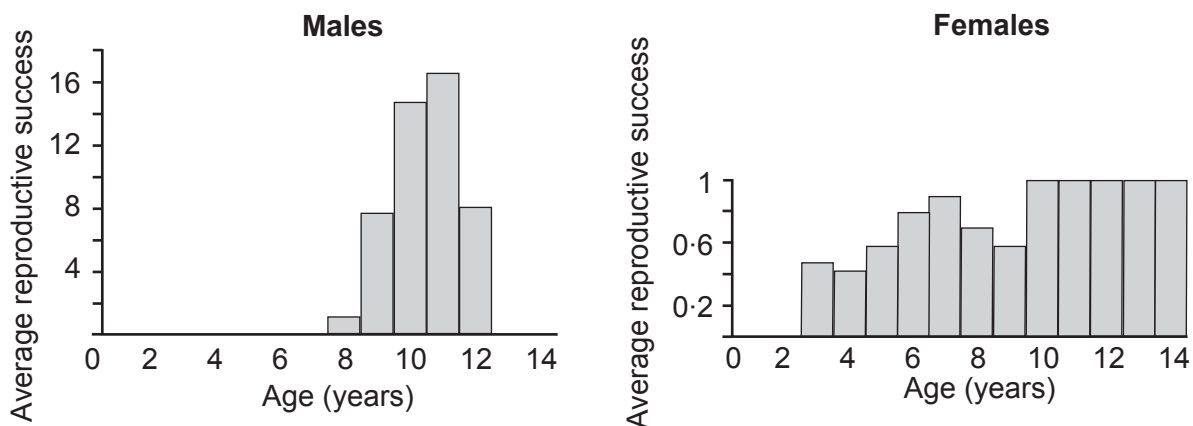
- (i) new alleles. (1 mark)

- (ii) random changes in allele frequencies. (1 mark)

- (iii) adaptive changes in allele frequencies. (1 mark)

Question 31 (continued)

The figure below shows the average reproductive success (average number of offspring) in male and female elephant seals at different ages.



- (e) (i) Compare the patterns of reproductive success in male and female elephant seals. (4 marks)

- (ii) Male elephant seals are substantially larger than female elephant seals. Sexual selection is mainly responsible for this difference. Explain how sexual selection has led to larger male elephant seals. (2 marks)

Question 32

(20 marks)

In Australia it is legal to keep and breed some species of native birds, reptiles and amphibians as pets. Some people see this as a conservation strategy that can help to prevent the extinction of endangered species. Most biologists, however, consider this to be a risky practice that can have harmful effects. Even though they are native to Australia, pets may escape into areas where they do not exist naturally. Also, these captive-bred animals may not be suitable for rebuilding natural populations.

(a) For each of the following, identify **two** possible ways in which native animals kept as pets could be

(i) harmful to local ecosystems if they escape. (2 marks)

(ii) unsuitable for release into natural populations in the wild. (2 marks)

In Western Australia, the people who trade in and keep native species as pets are regulated by laws.

(b) Suggest **two** appropriate regulations, one concerning traders and one concerning pet owners. For each regulation, explain how it would help to minimise harmful environmental impacts.

(i) Traders (2 marks)

(ii) Pet owners (2 marks)

See next page

Question 32 (continued)

Biologists in zoos, universities and other organisations are involved in a wide range of captive breeding programs that aim to conserve threatened species.

(c) Distinguish between each of the following pairs of terms.

(i) Inbreeding and outbreeding (2 marks)

(ii) Artificial selection and natural selection (2 marks)

(d) Identify and explain **two** ways that DNA profiling might be used to improve captive breeding programs for species conservation. (4 marks)

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(e) (i) Describe the main features of a seed bank program. (2 marks)

(ii) Describe **one** example of how a seed bank might be useful in a conservation program. (2 marks)

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Question 33

(20 marks)

A species of grasshopper lives on mountain slopes in the Australian Alps. The grasshoppers are active during the day. At night they are inactive and shelter in bushes. When active, they change their colour. This is measured on a simple scale with ratings from 1 to 4. The lightest colour (pale blue) is indicated by 1 and the darkest colour (black) is indicated by 4.

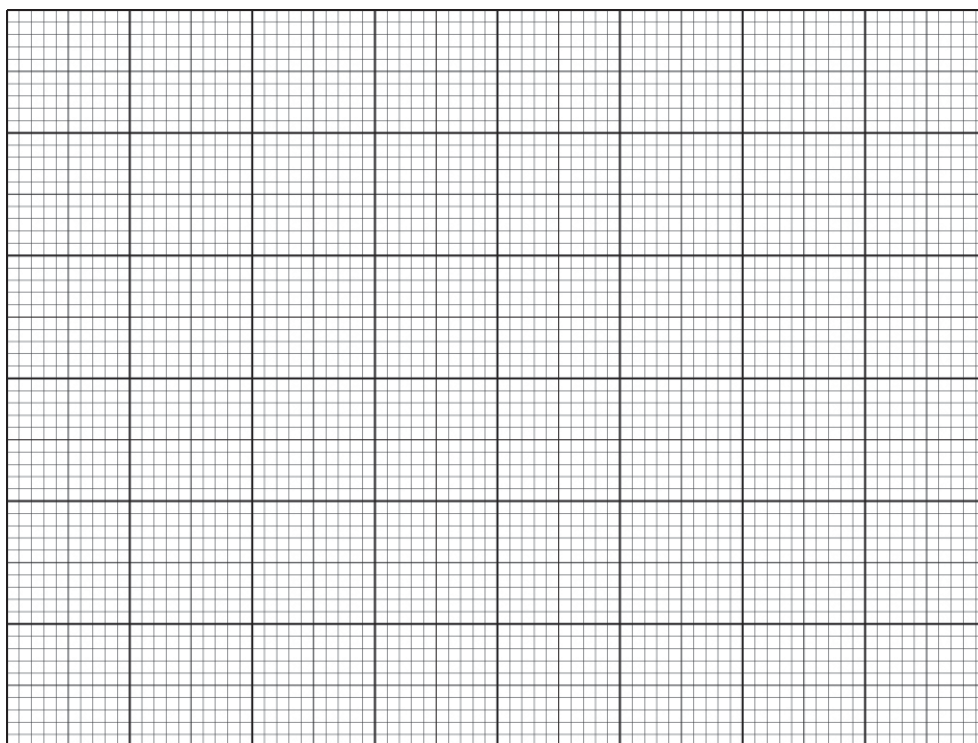
Biologists studying these grasshoppers recorded the air temperature and the colour rating of active grasshoppers at different times of a day at the end of summer in the Australian Alps.

The results are shown below.

The air temperature and the colour rating of active grasshoppers

Air temperature (°C)	Colour rating of active grasshoppers (1 to 4)
3	3.75
6	3.25
7	3.00
9	2.50
11	2.00
12	1.75

- (a) On the grid provided, graph these data. (6 marks)
 If you wish to make a second attempt at this item, the grid is repeated at the end of the Question/Answer Booklet. Indicate clearly on this page if you have used the second grid and cancel the working on the grid on this page.



See next page

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(b) Describe the relationship between air temperature and the colour rating of the grasshoppers. (2 marks)

(c) (i) From your graph, estimate the grasshopper colour rating at (2 marks)
15 °C _____
10 °C _____

(ii) In which estimate do you have greater confidence? Explain. (2 marks)

(d) Sheltering in the bushes at night enables the grasshoppers to be protected from predators. (4 marks)
Explain why some predators can be out moving around at night in the cold but the grasshoppers cannot.

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Question 33 (continued)

Scientists use various biological field techniques to study organisms in their natural habitats.

(e) Name and describe a field technique that could be used to

(i) capture active grasshoppers. (2 marks)

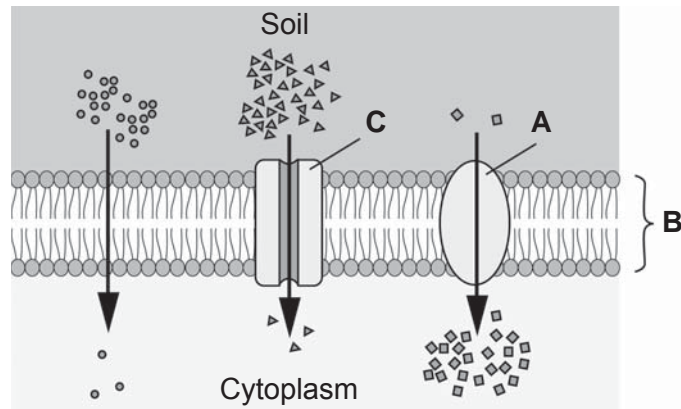
(ii) determine the distribution of a plant species. (2 marks)

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Question 34

(20 marks)

The root hairs of a plant must take up water and many ions, including potassium ions, from the surrounding soil. A model of the cell membrane in a root hair cell is shown below.



(a) (i) Name the structures labelled A and B in the diagram above. (2 marks)

A _____

B _____

(ii) Through which structure of the root hair cell membrane would oxygen mainly be transported? (1 mark)

(iii) Through which structure of the root hair cell membrane would passive transport of dissolved mineral ions mainly occur? (1 mark)

(b) Potassium ions are usually lower in concentration in the soil than in the root hairs of a plant. Therefore they must, at most times, be actively transported across the cell membrane into the root hair cell.

Explain how potassium ions are actively transported across the cell membrane into the root hair cell. (4 marks)

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Question 34 (continued)

- (c) Many proteins are produced in the ribosomes within the cytoplasm of a cell.

How does messenger RNA determine the sequence of amino acids during protein synthesis? (4 marks)

- (d) Proteins that leave the cell after synthesis are packaged by the Golgi apparatus and transported to the cell membrane.

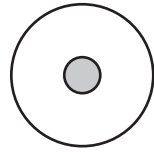
- (i) Name the structures in which proteins are transported to the cell membrane. (1 mark)

- (ii) Name and describe the process by which the packaged proteins are transported to the outside of the cell. (3 marks)

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- (e) Two types of cell were subjected to a number of different treatments. The treatments consisted of immersing the cells in solutions of different ion concentrations.

The appearance of the cells at the beginning of the investigation is shown below.



Cell type A



Cell type B

After several minutes in the solutions the following changes in the cells were observed.

Treatment 1	Treatment 2	Treatment 3
Treatment 4	Treatment 5	Treatment 6

- (i) In which of the treatments was the concentration of ions higher in the solution than within the cell? (1 mark)

- (ii) The concentration of the solution was the same in Treatments 2 and 6. Explain why the results were different. (3 marks)

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Question 35

(20 marks)

Dry land salinity is a major problem in Australian agricultural areas and especially in south-western Australia.

- (a) Explain how the activities of humans have contributed to this problem. (4 marks)

- (b) Identify **two** effects dry land salinity could have on nearby natural ecosystems and explain why each of these creates a problem for native species. (4 marks)

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- (c) A popular strategy to combat dry land salinity is to revegetate affected areas with salt tolerant plants. A study was conducted to determine which species would be suitable for this purpose. Groups of 20 potted seedlings of five plant species were watered with different salt concentrations for a 12 week period. The number of seedlings that survived after 12 weeks are shown in the table below.

Number of seedlings surviving after being subjected to salt solutions of varying concentrations for a 12 week period

Salt concentration of water used (g/L)	Number				
	Species 1	Species 2	Species 3	Species 4	Species 5
0	20	20	20	19	20
10	20	10	19	19	18
20	16	15	4	18	12
30	4	0	1	0	6
40	0	0	0	0	4

- (i) For the above investigation, what is the dependent variable? Justify your answer. (2 marks)

- (ii) Name **two** variables that would need to be controlled in this experiment. (2 marks)

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Question 35 (continued)

- (d) Suggest **two** additional pieces of information that would help you to select the most suitable revegetation species from the table. Provide a reason for each of your suggestions. (4 marks)

- (e) A plant species was found that was able to grow in soils with a salt concentration well in excess of 100g/L. The species is not suitable for revegetation of saline agricultural areas because it is poisonous to farm animals.

Summarise how recombinant DNA techniques could be used to take advantage of this plant's salt resistance in other, more suitable species. (4 marks)

End of Section Two

See next page

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Section Three: Extended answer**20% (40 Marks)**

Section Three consists of two parts each with three questions. You must answer **two** questions from **each** part.

Part A questions are below and are repeated on page 32.

Part B questions commence on page 37 and are repeated on page 42.

Use black or blue pen or ballpoint for written answers and pencil for diagrams. Crossing out incorrect material is acceptable and preferable to using correction fluid.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 50 minutes.

Part A

Answer any **two (2)** questions from Questions 36 to 38.

(20 marks)

Indicate the first question from Part A you will answer by ticking the box next to the question. Write your answer on pages 28–31. When you have answered your first question, turn to page 32 and indicate the second question you will answer on that page.

Question 36**(10 marks)**

Describe the similarities and differences between anaerobic and aerobic respiration in terms of sites, requirements and products. Include any differences between plants and animals.

Question 37**(10 marks)**

In this course you have studied the concept of biodiversity at three different levels. Describe these three levels. Explain why it is important to maintain biodiversity at each of these levels.

Question 38**(10 marks)**

Describe, using scientific terminology, the main steps involved in DNA replication in a living cell.

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Part A**(20 marks)**

Indicate the second question from Part A you will answer by ticking the box next to the question. Write your answer on the pages provided.

Question 36**(10 marks)**

Describe the similarities and differences between anaerobic and aerobic respiration in terms of sites, requirements and products. Include any differences between plants and animals.

Question 37**(10 marks)**

In this course you have studied the concept of biodiversity at three different levels. Describe these three levels. Explain why it is important to maintain biodiversity at each of these levels.

Question 38**(10 marks)**

Describe, using scientific terminology, the main steps involved in DNA replication in a living cell.

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Part B

(20 marks)

Answer any **two (2)** questions from Questions 39 to 41.

Indicate the first question from Part B you will answer by ticking the box next to the question. Write your answer on pages 38–41. When you have answered your first question, turn to page 42 and indicate the second question you will answer on that page.

Question 39**(10 marks)**

Although photosynthesis occurs during the day, not all stages of the process require sunlight.

Discuss this statement, making reference to the reactions involved in photosynthesis, the sites at which they occur, their requirements and products.

Question 40**(10 marks)**

Harvesting of organisms in natural ecosystems can have harmful consequences for their communities.

Discuss **two** examples of organisms harvested for human use. Include in your answer for each example the name of the organism, the problems caused by the harvesting and a strategy used by government authorities to preserve the ecosystem.

Question 41**(10 marks)**

Genetic variation is a prerequisite for evolution. Mutation is one source of genetic variation and meiosis is another. Name and describe the **two** ways in which meiosis produces genetic variation.

Part B

(20 marks)

Indicate the second question from Part B you will answer by ticking the box next to the question. Write your answer on the pages provided.

Question 39**(10 marks)**

Although photosynthesis occurs during the day, not all stages of the process require sunlight.

Discuss this statement, making reference to the reactions involved in photosynthesis, the sites at which they occur, their requirements and products.

Question 40**(10 marks)**

Harvesting of organisms in natural ecosystems can have harmful consequences for their communities.

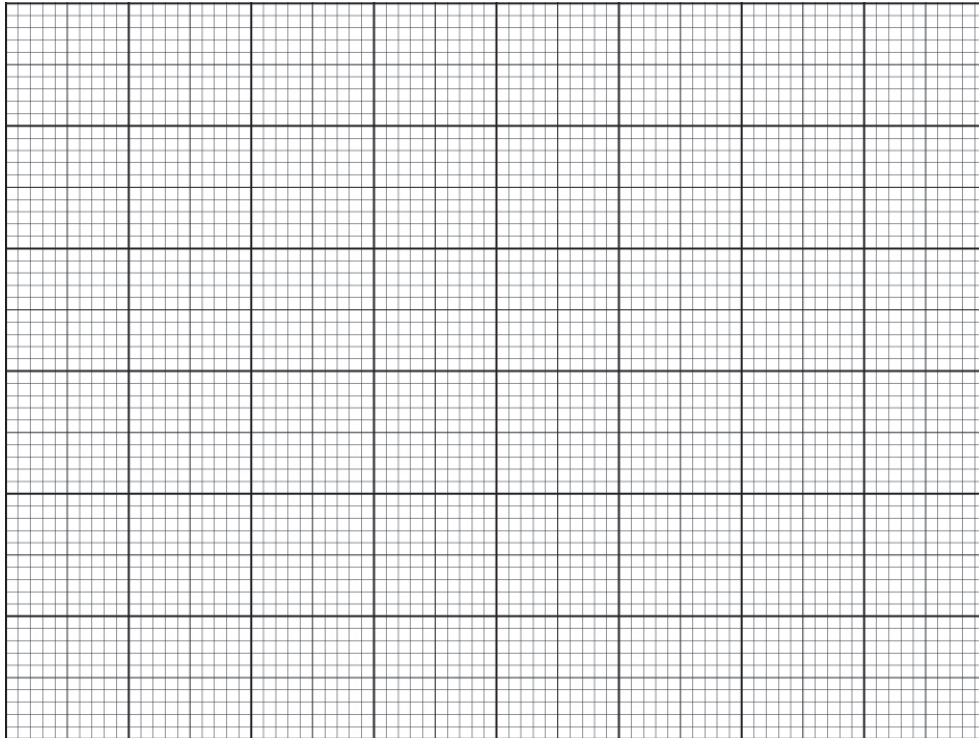
Discuss **two** examples of organisms harvested for human use. Include in your answer for each example the name of the organism, the problems caused by the harvesting and a strategy used by government authorities to preserve the ecosystem.

Question 41**(10 marks)**

Genetic variation is a prerequisite for evolution. Mutation is one source of genetic variation and meiosis is another. Name and describe the **two** ways in which meiosis produces genetic variation.

End of questions

Question 33



DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

ACKNOWLEDGEMENTS

Section One

- Question 4, 5, 6** Adapted from: Carr, S. M. (2009). Model of enzyme action [diagram]. Retrieved January, 2013, from www.mun.ca/biology/
- Question 23–25** Schuyler, Q., Hardesty, B.D., Wilcox, C., & Townsend, K. (2012). *To eat or not to eat? Debris Selectivity by Marine Turtles* [Figure 1]. Retrieved February, 2013, from www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0040884#pone-0040884-g001. Used under the Creative Commons Attribution 2.5 generic licence

Section Two

- Question 31 (b) and (c)** Adapted table: John, B., & Lewis, K.R. (1973). Chromosomes, DNA and meiosis. (Figure 3). *The Meiotic Mechanism*. Oxford: Oxford University Press, p. 4.
- Question 31(e)** Andersson, M. (1994). Mean reproductive success. (Figure 5.5.1) [Image]. *Sexual selection*. Princeton, New Jersey: Princeton University Press, p. 118.
- Question 34(a)** Adapted from: Reece, J.B., Urry, L.A., Meyers, N., Cain, M.L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B., & Cooke, B.N. (2011). Cell membrane [Diagram]. *Campbell Biology* (9th ed.). Melbourne: Pearson Education, p. 780.
- Question 34(e)** Adapted from: Victorian Curriculum and Assessment Authority (VCAA). (2003). *Biology Examination 1* (Questions 5 & 6, p. 4. Retrieved February, 2013, from www.vcaa.vic.edu.au/Documents/exams/biology/Biology12003.pdf

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