OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2021

Attach your candidate label here

ENVIRONMENTAL SCIENCE

ESS315118

Section 1

Pages	12
Questions	5
Information Sheet	1

Reading time: 15 minutes – you may begin writing during this time

Suggested working time: 36 minutes

Instructions

- Attempt **all** questions and **all** parts to the questions.
- Write your answers in the spaces provided in this exam paper.
- All answers must be written in **English**.
- You must make sure your answers address:
  - Criterion 2 develop, interpret and analyse experiments and investigations.

Marker use	
C2	35

Guide to Exam Structure

	Questions available	How many questions to answer	Suggested working time	Marks available
Section 1	5	5	36 minutes	35
Section 2	5	5	36 minutes	35
Section 3	5	5	36 minutes	35
Section 4	6	6	36 minutes	35
Section 5	5	5	36 minutes	35
Totals	**26**	**26**	**180 minutes (3 hours)**	**175**

Question 1

Marker use

The table below shows data for the number of whales hunted over a period of 60 years up until most countries stopped commercial whaling.

Statistics of whaling kills by species between 1910 and 1969.

Year	Blue	Fin	Humpback	Sei	Sperm	Others	**Total for period**
1910–19	26 819	42 410	52 113	7 160	6 112	37 246	**171 860**
1920–29	69 330	78 473	16 320	13 628	11 881	10 226	**199 858**
1930–39	170 855	141 988	34 632	7 724	29 031	8 164	**392 394**
1940–49	46 199	110 860	9 267	8 715	54 071	1 969	**231 081**
1950–59	29 618	263 121	32 618	29 180	147 172	1 483	**503 192**
1960–69	7 434	170 180	12 449	143 313	248 801	2 436	**584 613**
Total whales killed 1910–1969	350 255	807 032	157 399	209 720	497 068	61 524	**2 082 998**

Compiled from detailed yearly whaling statistics from http:luna.pos./whale/sta.html

a) Which species accounts for the most whales killed?

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1

b) What trend is visible in the **total** number of whales killed over the sixty years?

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1

c) State the trends shown in the numbers of Blue Whales and Fin Whales over the sixty years and provide reasons for these trends.

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Total Q1

5

Question 2

Marker use

In the midlands of Tasmania, agriculture has altered the climate so that revegetation programs have been largely unsuccessful. Currently there are more frosts than previously. Frosts kill the eucalypt seedlings, particularly in shallow valleys or "frost hollows". In an effort to reduce the severity of frost in some areas, large patches of introduced Monterey Pines (*Pinus radiata*) have been planted and, when these trees mature, eucalypt seedlings are then being planted.

Patchwork planting of Pinus radiata *to reverse the climatic effects resulting from tree clearing*

Scientists appear to be testing the hypothesis:

"The severity of frost in midlands 'frost hollows' is reduced due to the planting of Monterey Pines."

a) Identify the independent variable in the hypothesis above and state how it could be manipulated.

2

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b) Identify the dependent variable in the above hypothesis and state how this could be measured.

2

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Question 2 continues

Marker use

/ 5

c) Outline an experimental method that investigates whether or not it is the severity of frosts that causes the death of eucalypt seedlings.

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Total Q2

/ 9

Question 3

Marker use

In an area where there has been a large number of Tasmanian Devils (*Sarcophilus harrisii*) recorded as roadkill, the authorities have experimented with two designs of "judder bars", small speed humps as shown below. The judder bars are designed to shake the vehicle and therefore force it to slow down whilst travelling through the area, in an effort to reduce the number of Tasmanian Devils being killed.

Type A *– Transverse Judder Bars*

Type B *– Diagonal Checkerboard Pattern*

a) State a control needed in this experiment. Why would it be necessary?

3

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Question 3 continues

Marker use

b) State **two (2)** uncontrolled variables in this experiment and describe a method by which the effect of these could be minimised or eliminated.

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c) Identify **one (1)** way in which the experimental testing of speed control devices could be improved.

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Total Q3

8

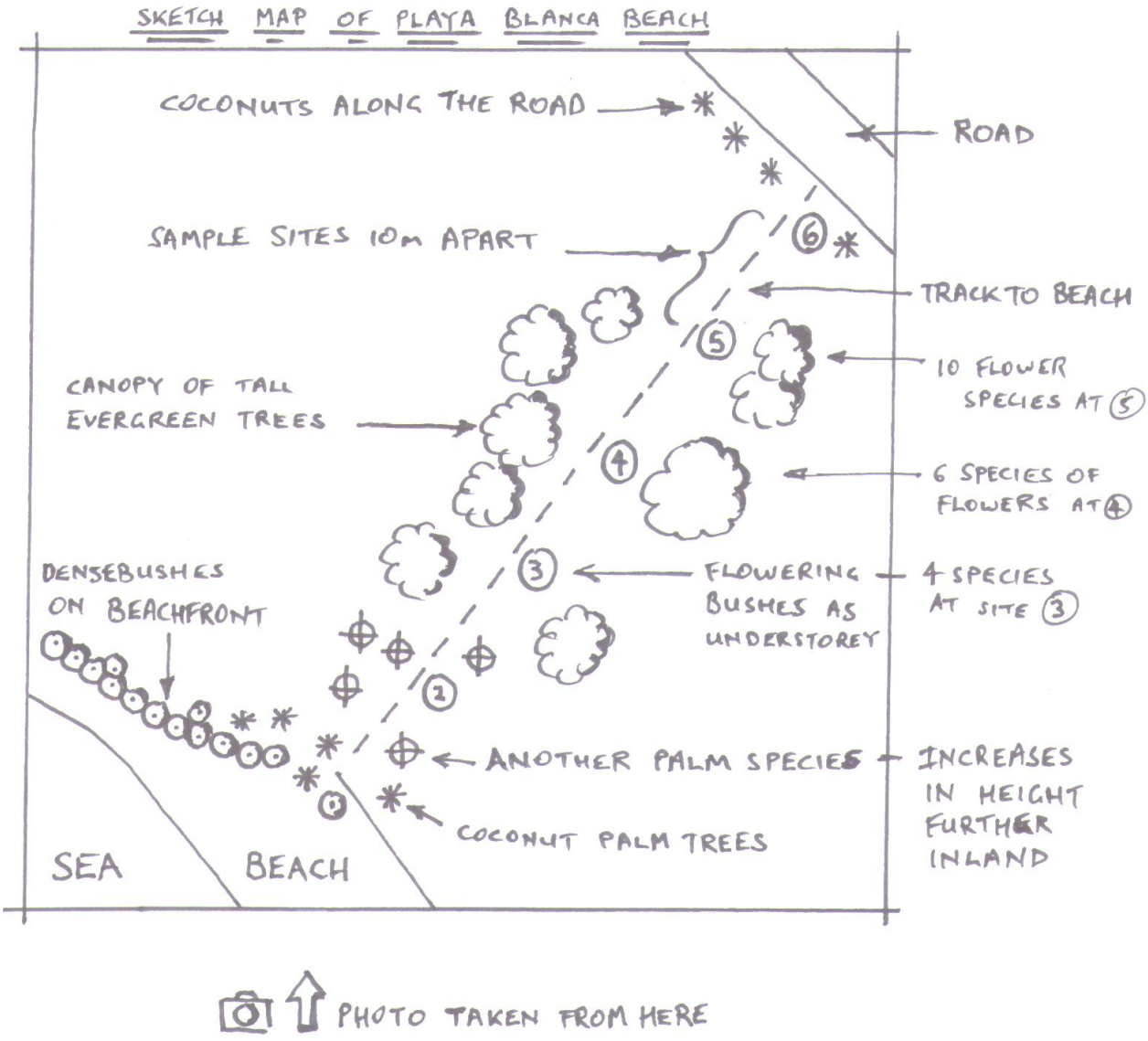
Question 4

Marker use

A student was studying the vegetation on the tropical island shown in the photograph below.

View of the vegetation on a tropical island

The following diagram shows the observations made in the student's notebook.



Question 4 continues

Question 4 continued

Marker use

a) Describe how this study may have been carried out using any appropriate terms for the methods used.

3

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b) Using the information from the sketch map, produce a table with **column headings** for further study (data not required in the table).

3

c) Outline **one (1)** improvement that could be made to this survey to make it more valid.

2

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Total Q4

8

Question 5

Marker use

The Tasmanian Giant Freshwater Crayfish or Lobster (*Astacopsis gouldii*) is only found in the rivers of northwest Tasmania that drain to Bass Strait and the nearby Arthur River that drains west into the Southern Ocean. The conservation status of *Astacopsis gouldii* is "endangered", with populations threatened by the disturbance of the pristine riverine environment necessary for its survival.

The Tasmanian Giant Crayfish may grow to 80 cm and over 6 kg

a) Why could *Astacopsis gouldii* be considered an Index Species?

1

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b) State **two (2)** abiotic factors of a stream with water quality suitable for crayfish habitation. Justify your choices.

4

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Total Q5

5

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End of Section 1

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OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

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ENVIRONMENTAL SCIENCE

ESS315118

Section 2

Pages	16
Questions	5
Information Sheet	1

Suggested working time: 36 minutes

Instructions

- Attempt **all** questions and **all** parts to the questions.
- Write your answers in the spaces provided in this exam paper.
- All answers must be written in **English**.
- You must make sure your answers address:
  - Criterion 5 apply ecological concepts and processes.

Marker use	
C5	35

Guide to Exam Structure

	Questions available	How many questions to answer	Suggested working time	Marks available
Section 1	5	5	36 minutes	35
Section 2	5	5	36 minutes	35
Section 3	5	5	36 minutes	35
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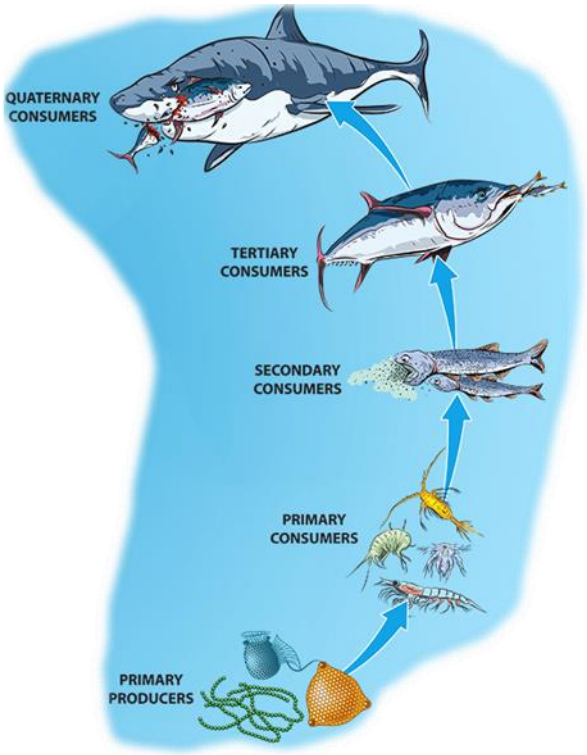
Totals	**26**	**26**	**180 minutes (3 hours)**	**175**

Question 6

Marker use

The following diagram represents a marine food chain.



A marine food chain

a) Sketch and label a Pyramid of Biomass for this food chain in the space below.

3

Question 6 continues

Question 6 continued

Marker use

a) Which group of organisms are missing from this marine food chain and outline their role?

/2

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b) State the original source of energy in this ecosystem and describe what happens to the flow of energy through the food chain shown in the diagram.

/3

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Total Q6

/8

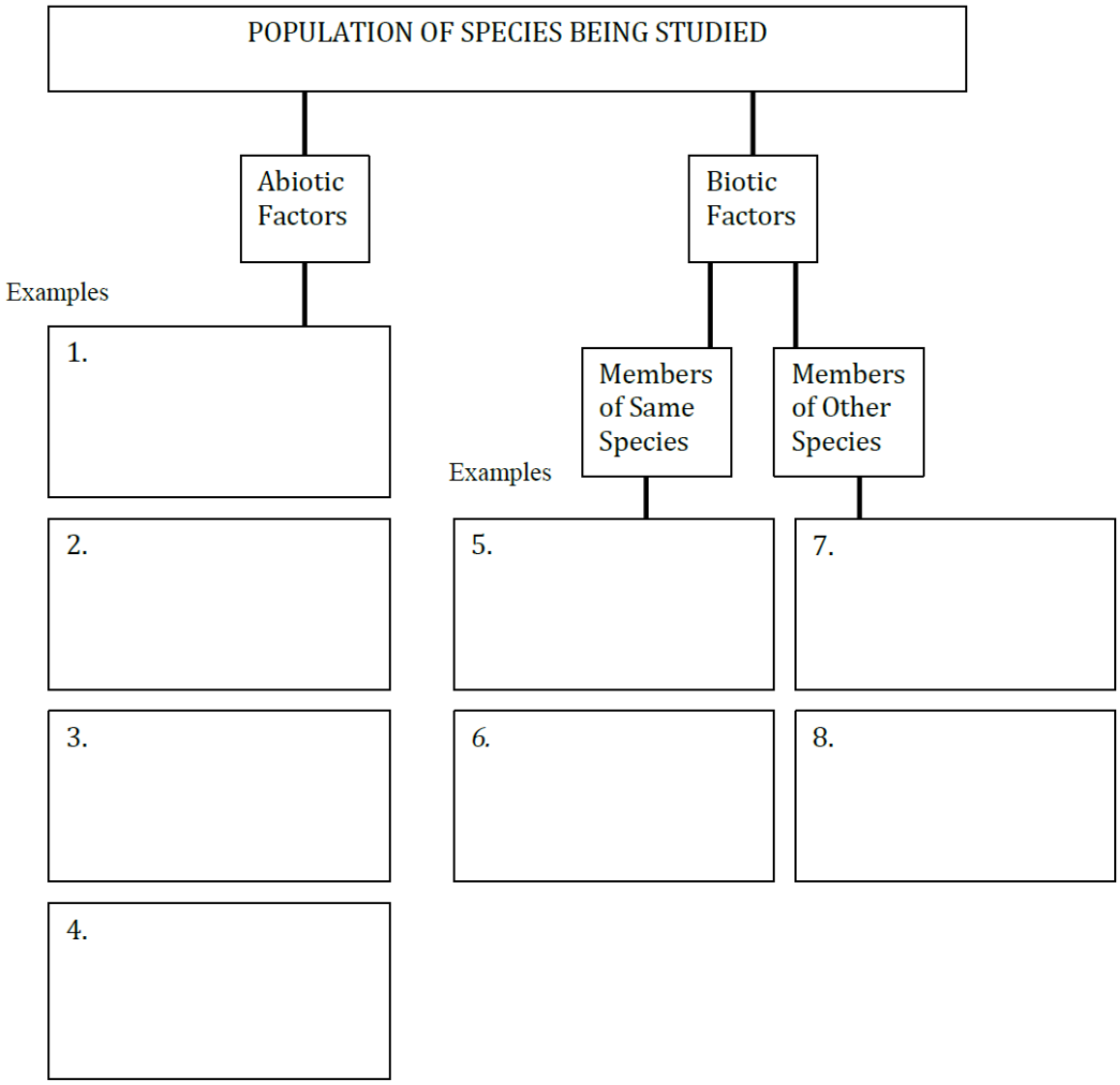
Question 7

Marker use

Population ecology looks specifically at the factors that affect one particular species to determine whether the impact of this factor is causing the population to increase or decrease. Systematically it can be represented as shown in the diagram below.

Complete the diagram by giving one example of each factor in the boxes below.

4



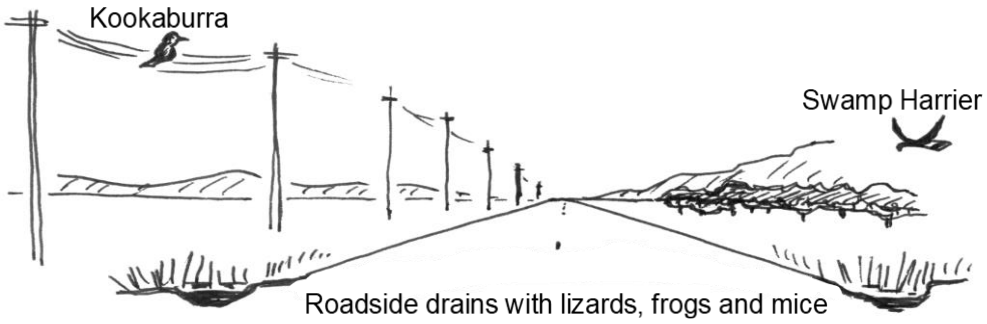
Total Q7

4

Question 8

Marker use

The Kookaburra (*Dacelo novaeguineae*) is a species introduced to Tasmania. It is an ambush predator that is often seen sitting on powerlines watching the grassy habitat around drains at the sides of roads. The native Swamp Harrier (*Circus approximans*) also hunts in this modified habitat and can often be seen gliding above the roadside drains before it swoops on its prey. Both the Kookaburra and the Swamp Harrier live off lizards, frogs and small mammals such as mice and rats.



Roadside habitat

a)

i. State the relationship of the Kookaburra to the lizard.

1

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ii. State the relationship of the Kookaburra to the Swamp Harrier.

1

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Question 8 continued

Marker use

4

b) Observations seem to indicate that both species of birds, the Kookaburra and the Swamp Harrier, occupy the same niche. With respect to these two species, describe the meaning of the term ***niche***, and explain how both the Kookaburra and the Swamp Harrier can survive in this habitat even if they seem to be hunting for the same prey.

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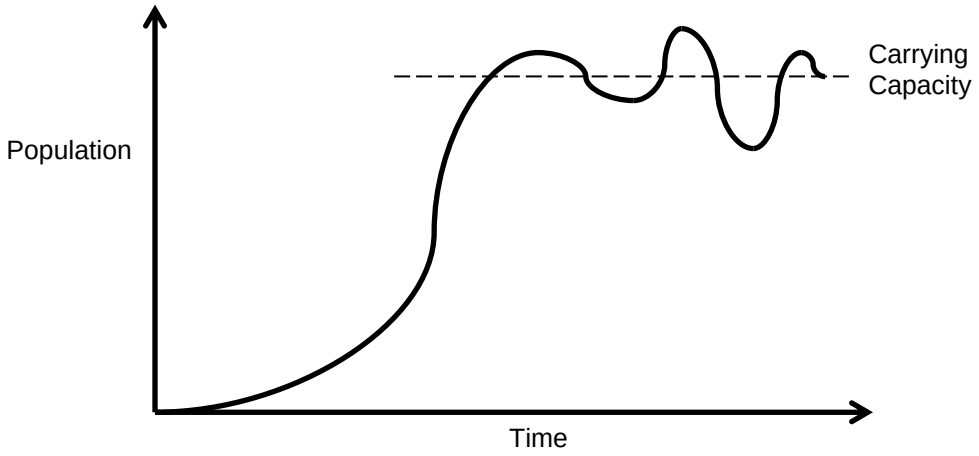
Total Q8

6

Question 9

Marker use

The diagram below shows the population growth of species of organism that has colonised a new habitat. The curve is referred to as an S-Curve and the section at the top right indicates that the species is at its carrying capacity.



a) Define what is meant by the term carrying capacity. 1

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b) Explain why the line showing the population fluctuates around the carrying capacity. 4

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Question 9 continues

Marker use

/ 3

c) All populations tend to expand their range until they find themselves in a place where they are subject to physiological stress. Outline what is meant by physiological stress, giving an example of how the range of a particular species may be limited.

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Total Q9

/ 8

Question 10

Marker use

The following maps show the distribution of the three main forest types in Tasmania.

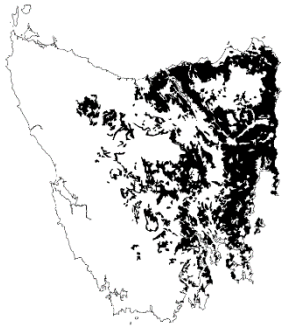
Cool Temperate Rainforest in Tasmania

■ Rainforest

Wet Eucalypt Forest in Tasmania

■ Wet Eucalypt Forest

Dry Eucalypt Forest in Tasmania



■ Dry Eucalypt Forest

a) Explain how rainfall accounts for the distribution, species and structure of these forests.

4

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Question 10 continues

Marker use

5

b) How does fire assist forest regeneration AND does fire have the same effect on the three forest types shown on the map on page 10?

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Total Q10

9

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End of Section 2

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ENVIRONMENTAL SCIENCE

ESS315118

Section 3

Pages	12
Questions	5
Information Sheet	1

Suggested working time: 36 minutes

Instructions

- Attempt **all** questions and **all** parts to the questions.
- Write your answers in the spaces provided in this exam paper.
- All answers must be written in **English**.
- You must make sure your answers address:
  - Criterion 6 apply concepts and processes of ecosystems change.

Marker use	
C6	35

Guide to Exam Structure

	Questions available	How many questions to answer	Suggested working time	Marks available
Section 1	5	5	36 minutes	35
Section 2	5	5	36 minutes	35
Section 3	5	5	36 minutes	35
Section 4	6	6	36 minutes	35
Section 5	5	5	36 minutes	35
Totals	**26**	**26**	**180 minutes (3 hours)**	**175**

Question 11

Marker use

The Great Barrier Reef, the world's largest coral reef, has been under threat from two of the main consequences of the enhanced greenhouse effect; namely ocean warming and increased ocean acidity.

a) Briefly outline how the world's oceans are becoming warmer.

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b) Briefly outline how the world's oceans are becoming more acidic.

2

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c) Global warming has meant there are two factors involved in sea level rise. Explain how each of these **two (2)** factors operates to produce sea level rise.

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Total Q11

8

Question 12

Marker use

For many decades the Swift Parrot (*Lathamus discolor*) has been endangered in Tasmania. Initially it was thought that this was due to habitat loss as a result of the clearing of Tasmanian Blue Gums (*Eucalyptus globulus*). Recent hidden camera footage has revealed that one of the greatest threats to Swift Parrots is predation from Sugar Gliders (*Petaurus briviceps*), which were introduced to the Tasmanian mainland in the 1830s. The Sugar Gliders raid the Swift Parrot nests for eggs and young chicks.

There are no Sugar Gliders on Bruny Island and Swift Parrot numbers are not declining.

Sugar Glider

Swift Parrot

a) Explain why introduced species such as the Sugar Glider are able to thrive in a new habitat.

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b) Explain why attempted eradication programs for introduced species are often unsuccessful.

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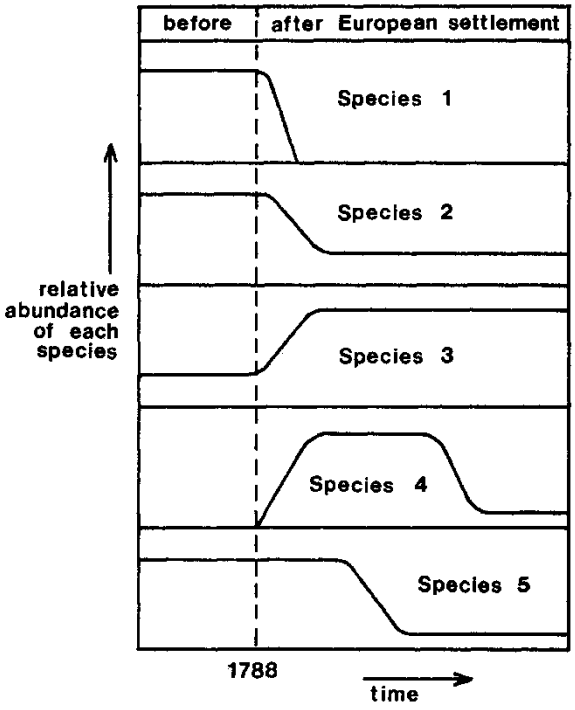
Total Q12

6

Question 13

Marker use

The diagram shows, in a simplified manner, changes in the relative abundance of 5 species since the European settlement of Australia.



a) Complete the table for each species from the diagram above:

2

Species	1	2	3	4	5
Is the species introduced (Yes/No)					

b) Provide an explanation for the shape of the graphs for the following species:

4

Species 2: .....

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Species 3: .....

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Total Q13

6

Question 14

Marker use

Urban development along some rivers has changed the ecosystem from that shown in Figure 1 to that shown in Figure 2.

Figure 1

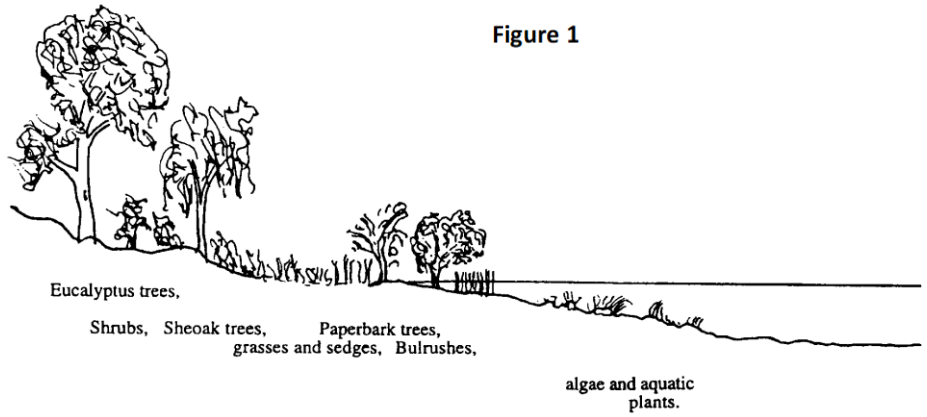
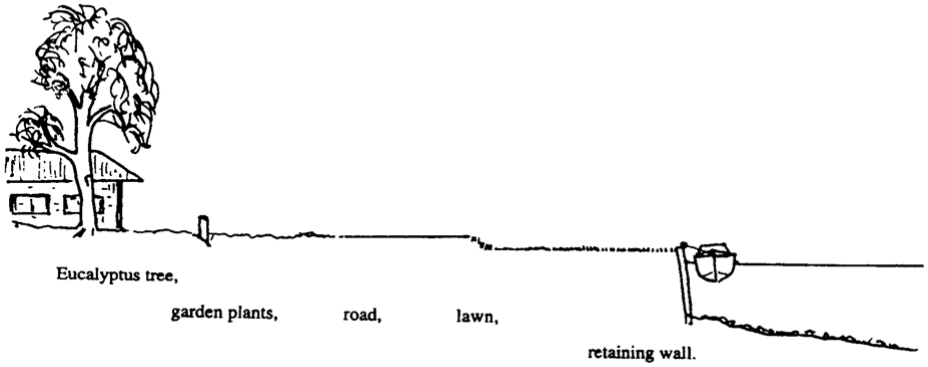


Figure 2



a) Describe ways in which changes from Figure 1 to Figure 2 could alter the manner in which the ecosystem functions.

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Question 14 continues

Marker use

4

b) Many rivers in Tasmania flow through land which has been developed for agriculture in the last 100 years. Describe the changes in these rivers which may have been brought about by:

i. Damming of rivers: .....

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ii. Allowing cattle access to the river: .....

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Total Q14

9

Question 15

Marker use

The Arid Recovery Area covers a 123 km^2 area of inland South Australia. The area is fenced to stop invasive feral species. Within the fenced area, feral species have been eliminated and endangered native species reintroduced. People can only visit the area under special circumstances, usually to conduct conservation work and scientific studies. The project is trying to recreate the community of organisms and complex food webs that existed in the area prior to settlement.

Explain how a complete community of organisms within an area such as this contributes to the three types of biodiversity.

/ 6

Genetic: .....

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Species: .....

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Ecosystem: .....

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Total Q15

/ 6

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End of Section 3

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Section 4

Pages	16
Questions	6
Information Sheet	1

Suggested working time: 36 minutes

Instructions

- Attempt **all** questions and **all** parts to the questions.
- Write your answers in the spaces provided in this exam paper.
- All answers must be written in **English**.
- You must make sure your answers address:
  - Criterion 7 apply concepts relating to human dependence and impact on ecosystems.

Marker use	
C7	35

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Guide to Exam Structure

	Questions available	How many questions to answer	Suggested working time	Marks available
Section 1	5	5	36 minutes	35
Section 2	5	5	36 minutes	35
Section 3	5	5	36 minutes	35
Section 4	6	6	36 minutes	35
Section 5	5	5	36 minutes	35
Totals	**26**	**26**	**180 minutes (3 hours)**	**175**

Question 16

Marker use

In many overseas countries Honey Bee (*Apis mellifera*) populations are under threat from the parasitic mite (*Varroa destructor)*. This may lead to local extinction of bees on most continents other than Australia, which is so far free of this pest.

A bee carrying a parasitic Varroa Mite (L) and a close-up of the Varroa Mite (R)

Outline the ecosystem's services and consequences that would be lost if bees became extinct.

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Total Q16

3

Question 17

Marker use

Aquaculture, particularly the farming of Atlantic Salmon (*Salmo salar*) is a profitable Tasmanian industry where the right environmental conditions are available. Recently there has been some public concern about the industry.

A typical Tasmanian fish farm

Explain **two (2)** environmental impacts of intensive fish farming in the waters around Tasmania, stating the cause and how these impacts may alter the ecosystem.

/ **4**

Impact 1: .....

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Impact 2: .....

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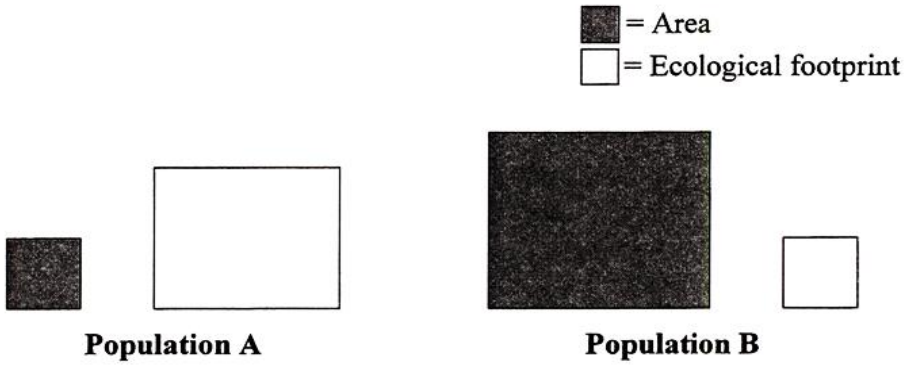
Total Q17

/ **4**

Question 18

Marker use

Whilst the population of less developed nations is generally greater than the populations of more developed nations, the impact on the environment of the people in developed nations is greater because it is greater ***per capita*** as shown in the diagram below.



a) Explain what is meant by impact per capita.

1

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b)

i. State which of these two, Population A or Population B, represents the developing nation.

1

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ii. Explain why less developed nations have a different ecological footprint compared to more developed nations.

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Question 18 continues

Marker use

c) Explain how the consequences of a large ecological footprint relate to carrying capacity.

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/2

Total Q18

/7

Question 19

Marker use

a) Explain the reasons why electric vehicles are seen as the better environmental alternative to petrol driven vehicles.

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b) Outline some of the potential pollution and other environmental problems associated with the manufacture and use of electric cars.

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Total Q19

8

Question 20

Marker use

Mice have become a significant problem throughout much of Australia this year and are occurring in plague portions, impacting the agriculture sector. One solution suggested is to use a powerful bait to control the mice plague. This powerful bait has currently been outlawed for use in fields.

Discuss some of the environmental impacts on the ecosystem of using this bait.

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Total Q20

4

Question 21

Marker use

Marine debris is a growing threat to hundreds of marine animal species. To understand the consequences of marine debris to wildlife populations, researchers investigated a group of seabirds (albatrosses, shearwaters and prions) that are globally threatened. 63.2% of species are currently known to ingest plastic.

Marine debris digestion was examined in 972 seabirds. One aspect of this study investigated the composition of ingested debris.

The graphs A, B, C and D show the mean numbers (± standard error) of differing types of marine debris items ingested by immature and adult seabirds across four diet groups.

The shape of the natural food is shown in grey on the graphs.

a) State the dominant food type that is **only** eaten by immature birds. **1**

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b) Compare the diet of immature seabirds with adult seabirds in terms of:

i. Type of food. **2**

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ii. Type of plastics found in their gut. **2**

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c) Explain the relationship between the food they eat and the plastic debris in both immature and adult seabirds. **2**

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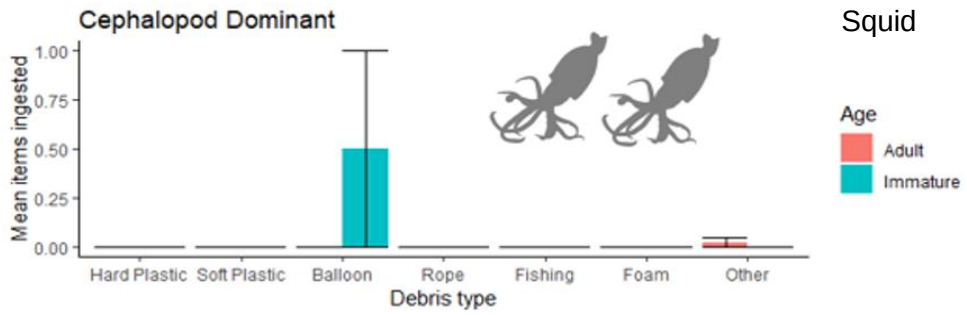
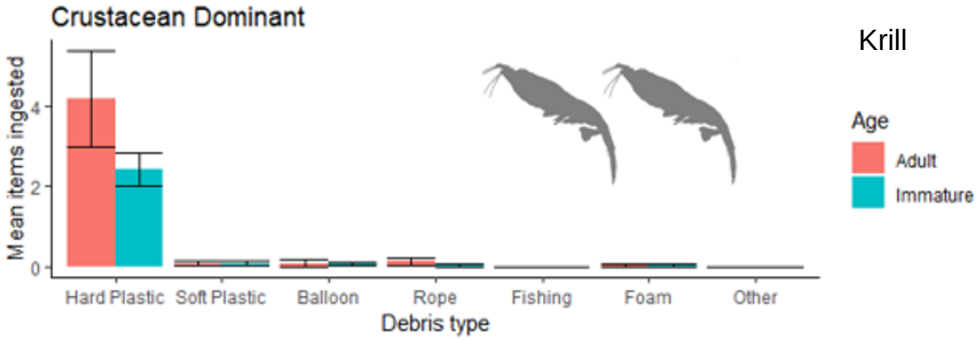
Question 21 continues

Marker use

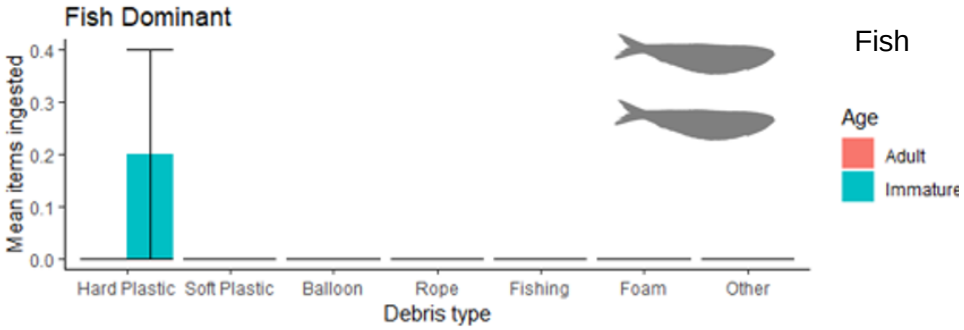
A



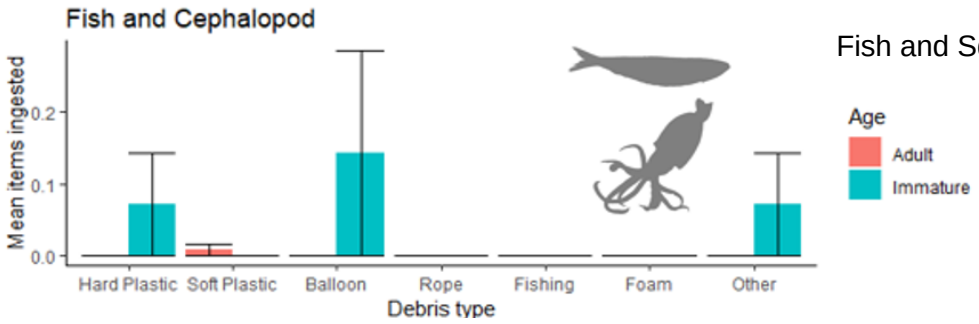
B



C



D



d) From other results it was concluded that hard plastic caused a higher mortality in the smaller prions than in the larger albatrosses. Give a reason as to why that might be?

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Total Q21

/ 9

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End of Section 4

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Section 5

Pages	12
Questions	5
Information Sheet	1

Suggested working time: 36 minutes

Instructions

- Attempt **all** questions and **all** parts to the questions.
- Write your answers in the spaces provided in this exam paper.
- All answers must be written in **English**.
- You must make sure your answers address:
  - Criterion 8 apply principles and processes related to ecologically sustainable management of the environment.

Marker use	
C8	35

Guide to Exam Structure

	Questions available	How many questions to answer	Suggested working time	Marks available
Section 1	5	5	36 minutes	35
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Section 3	5	5	36 minutes	35
Section 4	6	6	36 minutes	35
Section 5	5	5	36 minutes	35
Totals	**26**	**26**	**180 minutes (3 hours)**	**175**

Question 22

Marker use

A winery in northern Tasmania, that has been in the same family for a number of generations, offers wine tasting, cellar door wine sales, a café and other meal facilities. In this respect it is no different to other Tasmanian wine businesses. The winery is considering installing an electric car charging station run from solar (photovoltaic) cells on the property, so that guests can charge their electric car during lunch at the winery. The winery has set aside areas of native bush on the property as habitat for native birds that control insect pests. They also run a small vineyard where they grow different varieties of grapes, in non-commercial quantities, as a genetic library to maintain grape biodiversity. This winery offers interpretation signage. Wines from this vineyard are more expensive than at other wineries but this extra cost covers such things as waste management.

Complete the table below by identifying **one (1)** aspect of the winery's practice that satisfies each of the following Principles, Strategies and Approaches to sustainable practice.

/ 6

(You may use an aspect **more than** once and the first one is done for you.)

Aspects of Sustainability	**Winery Practice**
Principles of Sustainability	
Ecological Integrity	*Birds from the native vegetation control the insects*
Intergenerational Equity	
Intra-generational Equity	
Strategies for Sustainable Development	
Precautionary Principle	*Not applicable*
Full Cost Pricing Principle	
Efficient Use of Resources	
Approaches to Sustainability	
Education	
Economic Sustainability	

Total Q22

/ 6

Question 23

Marker use

Golf courses are often seen as acceptable developments because there is the opportunity to preserve areas of habitat such as patches of native woodland and sand dunes, although some developments have drained wetlands and subsequently reclaimed land by trucking in earth and soil. Recently in Tasmania, there have been a number of proposals to develop golf courses with accommodation and resort facilities attached that hopefully will attract interstate and overseas visitors.

Native vegetation incorporated in the golf course design

a) Explain the importance of maintaining areas of native vegetation including woodland, wetlands and sand dunes, in terms of sustainability.

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Question 23 continues

Marker use

b) Outline how the approval of golf course developments may be subject to the consideration and possible restrictions contained in Australian Federal legislation and various international conventions and agreements to which Australia is a signatory nation.

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c) In many cases environmental sustainability is only possible with economic sustainability. Discuss the advantages and disadvantages of providing accommodation facilities and attracting overseas visitors.

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Total Q23

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Question 24

Marker use

One proposal to save the Tasmanian Devil (*Sarcophilus harrisii*) from extinction in Tasmania, due to the effects of the Tasmanian Devil Facial Tumour Disease (TFTD), was to introduce Tasmanian Devils onto Maria Island. This initiative was opposed by conservationists in Tasmania.

Conservationists are often criticised because they seem to oppose almost all developments and changes. The conservationists would justify their opposition by referring to the Precautionary Principle.

a) Use the example of introducing Tasmanian Devils to Maria Island to explain what is meant by the **Precautionary Principle**.

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b) Justify whether introducing Tasmanian Devils to Maria Island is ecologically sustainable.

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Total Q24

/ **5**

Question 25

Marker use

The utilities water and electricity are billed to the customer in two parts:

- a standard service charge that covers the fixed costs of the service provider
- a usage charge that depends upon the amount consumed.

a) Explain how this pricing model is designed to use market forces to ensure a more sustainable approach to Australia's use of water and electricity.

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b) Describe how successful the model could be in terms of influencing consumer behavior.

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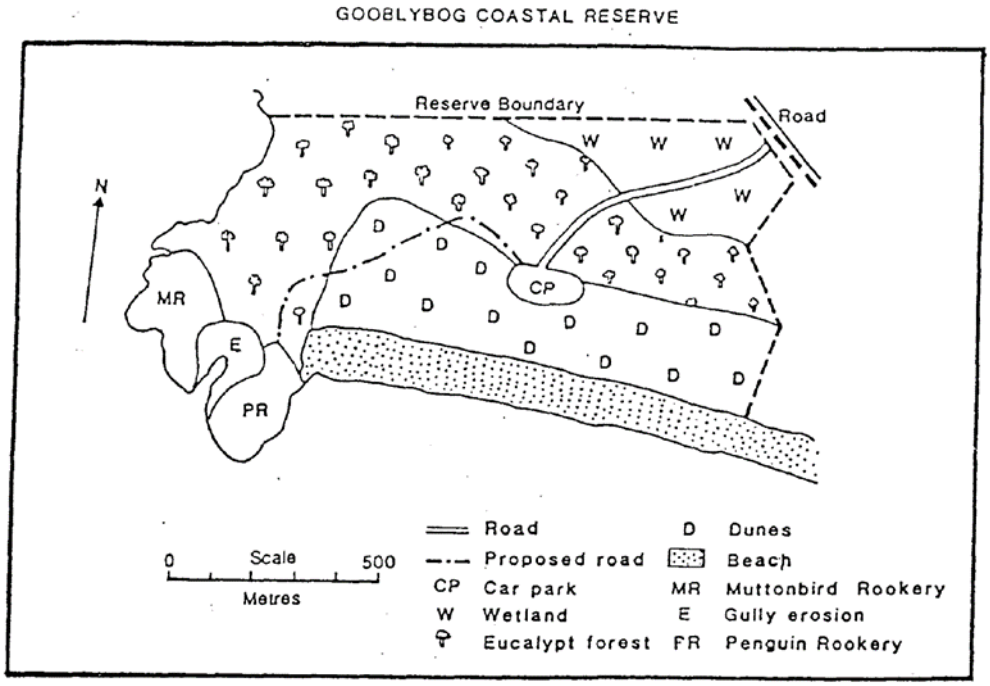
Total Q25

/ 4

Question 26

Marker use



The sketched map above shows an area popular with many different types of user groups including surfers, day-trippers, birdwatchers, hunters and off-road vehicle users.

There are basic conflicts between the different uses of this area and a planner would need to balance the conservation and recreational values.

With the above facts in mind, answer the following questions.

a) Choose **one (1)** of the above user groups that could have detrimental environmental impacts. Provide a reason for your choice.

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Question 26 continues

Marker use

b) A management plan is necessary to manage this area. Outline, using examples in the sketch on page 8, the aspects that need to be incorporated into the management plan.

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c) How could nearby residents be involved in the management of this area?

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Total Q26

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End of Section 5

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