## Section One: Multiple-choice 25% (25 marks)

This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade a 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: 25 minutes.

1.   An endemic species is one that

    (a)   can be found anywhere in the world.
    (b)   only occurs in a particular ecosystem or country.
    (c)   is endangered.
    (d)   has the ability to easily adapt to a new environment.

2.   Which of the following statements best describes an ecosystem?

    (a)   All the living factors that inhabit a particular area at a particular time.
    (b)   A group of individuals from the same species living in the same area.
    (c)   An interacting community of different species of organisms and the environment in which they live.
    (d)   A group of organisms that share the same habitat.

3.   Which of the following energy pyramids best reflects a cave ecosystem?
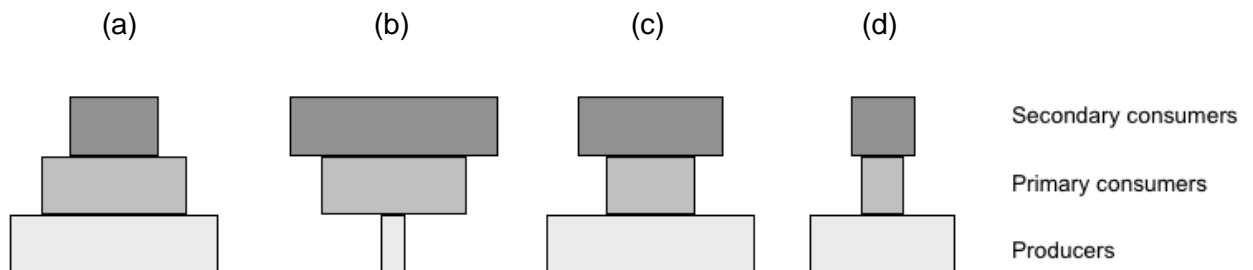
4.   The carrying capacity of an ecosystem refers to the

    (a)   number of organisms that can be supported given the available resources.
    (b)   number of different species that can be supported in a given area.
    (c)   ratio of primary producers to consumers.
   (d)   number of available niches.

Use the diagram below to answer questions 5 to 7.
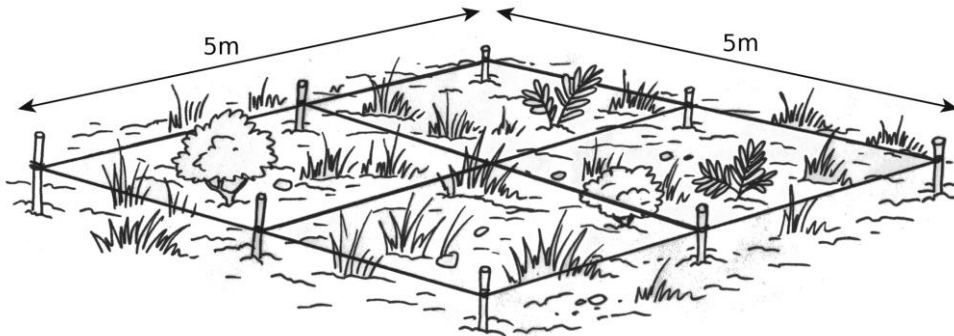
5.   Which method of ecological sampling is shown in the diagram above?

        (a)   Transects
        (b)   Quadrats
        (c)   Grid mapping
        (d)   Randomised grids

6.   Which of the following organisms would most likely be sampled using this method?

        (a)   Frogs, sea urchins and anemones.
        (b)   Insects, lizards and birds.
        (c)   Shrubs, grasses and burrowing marsupials.
        (d)   Trees, shrubs and fungi.

7.   The data collected from ecological surveys using this sampling method may be used to determine

        (a)   species richness.
        (b)   distribution of species.
        (c)   species abundance.
        (d)   all of the above.

8.   An organism's niche may be expanded if

        (a)   two or more species are competing for the same resource.
        (b)   competition between individuals of the same species increases.
        (c)   the abiotic factors change.
        (d)   the organisms occupying the niche become less specialised in their requirements for food and shelter.

9.   In an ecosystem, light intensity, rainfall and atmospheric temperature are examples of

        (a)   abiotic factors.
        (b)   essential factors.
        (c)   factors that are affected by climate change.
        (d)   biotic factors.

2

10. The endemic nature of the species that inhabit the threatened ecosystems of southwest Western Australia has led this region to be classified as a

   (a) wonder of the natural world.
   (b) World Heritage site.
   (c) biodiversity hotspot.
   (d) threatened ecological community.

11. The role of nitrifying bacteria in the nitrogen cycle is to

   (a) convert animal urea into ammonia.
   (b) 'fix' atmospheric nitrogen into ammonia.
   (c) convert ammonia into nitrates.
   (d) convert nitrates into atmospheric nitrogen gas (N_2).

12. The main factor contributing to dryland salinity in Australia is

   (a) climate change.
   (b) the construction of desalination plants.
   (c) urbanisation.
   (d) agricultural practice.

13. Agricultural run-off has a major impact on the health of the Great Barrier Reef. Sediments are flushed into the ocean from areas subject to severe erosion. What effect would an increase in sediments in the seawater have on the primary productivity of the coral reef ecosystems?

   (a) Reduce light penetration through the water and therefore decrease the rate of photosynthesis of aquatic plants, zooxanthellae and phytoplankton.
   (b) Smother the coral in sediments, resulting in a reduction in growth rate and spawning mechanisms.
   (c) Reduce the concentration of dissolved oxygen in the seawater, thereby affecting cellular respiration of marine organisms.
   (d) Cause fish kills due to fine particles smothering the gills of marine fish. This would cause an imbalance in the coral reef food web and increase primary productivity.

14. Autotrophs obtain food through

   (a) oxidation of inorganic molecules.
   (b) carbon sequestering.
   (c) photosynthesis.
   (d) decomposition of organic waste products.

15. Which organism in the food chain below would be most affected by biomagnification of toxic chemicals?

Grass ➡ Grasshopper ➡ Mouse ➡ Owl
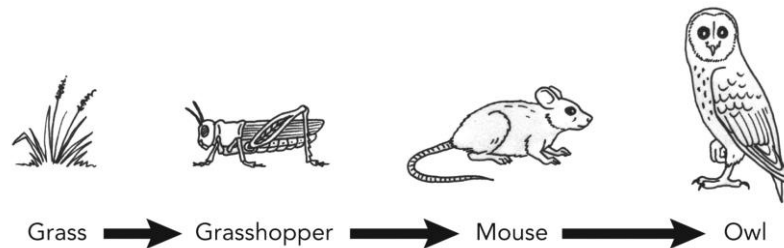
(a) Grass
(b) Grasshopper
(c) Mouse
(d) Owl

16. Earthworms play an important role in soil ecosystems through the breakdown of organic matter. In addition to ingesting organic waste, earthworms aerate the soil as they move around. How could aeration increase the rate of decomposition in the soil?

(a) Provides extra space for other organisms to inhabit the soil.
(b) Increases the oxygen content in the soil and therefore cellular respiration of microorganisms.
(c) Allows fungal mycelium to penetrate the soil more readily, increasing the assimilation of carbon.
(d) Aeration has no effect on the rate of decomposition in the soil.

17. The populations of native organisms are often self-regulating. Which factors would have the greatest impact on regulating a dense population?

(a) Rainfall and temperature.
(b) Fire and food resources.
(c) Drought and disease.
(d) Competition and predation.

18. In Western Australia, regular prescribed burning of natural bushland and forests is an important management strategy. Prescribed burning practices can reduce the incidence of destructive wildfire by

(a) reducing the density of vegetation in a given area.
(b) reducing the fuel load.
(c) providing breaks between areas of bushland that prevent the spread of fire.
(d) stimulating the germination of herbaceous species that have a high water content.

19. Which sampling method would be most effective at monitoring the progress of newly released marsupials from a captive breeding program?

(a) Capture-recapture.
(b) Radio-tracking.
(c) Remote satellite sensing.
(d) Pitfall trapping.

20. Extensive algal blooms in freshwater ecosystems are often followed by the death of aquatic organisms such as crustaceans and fish. This is the direct result of

   (a) an increase in the rate of photosynthesis in the water.
   (b) a decrease in light penetration.
   (c) a decrease in the pH of the water.
   (d) a decrease in dissolved oxygen caused by the decomposition of algae.

21. Agricultural ecosystems are more susceptible to disease and invasion by pests than natural ecosystems. The most likely reason for this is the

   (a) absence of animals that feed on insects.
   (b) use of herbicides and inorganic fertilisers.
   (c) lack of ecosystem stability due to low species diversity.
   (d) increase in biomass of primary producers.

22. Every organism, both living and fossilised, is assigned its own two-part scientific name. This process of naming is referred to as

   (a) classification.
   (b) taxonomic grouping.
   (c) hierarchical classification.
   (d) binomial nomenclature.

23. Phylogenetic classification of organisms is based on

   (a) genetic similarities.
   (b) structural characteristics.
   (c) morphological similarities.
   (d) common evolutionary descendants.

24. The Australian Green (weaver) Ant (*Oecophylla smaragdina*) is an aggressive and territorial species found in northern Australia. However, this ant has been filmed defending caterpillars while they feed off their sugary secretions. This type of symbiosis is known as

   (a) mutualism.
   (b) parasitism.
   (c) commensalism.
   (d) opportunistic feeding.

25. The majority of inorganic phosphorus molecules that enter the phosphorus cycle originate from

   (a) the decomposition of plants and animals.
   (b) rocks and sediments.
   (c) lightning.
   (d) the upwelling of nutrients from ocean depths.

End of Section One

5

Section Two: Short answer **65% (83 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 graphs and diagrams may be drawn in pencil.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Suggested working time: 90 minutes.

Question 26 **14 marks**

Below is a typical food web for a woodland ecosystem.
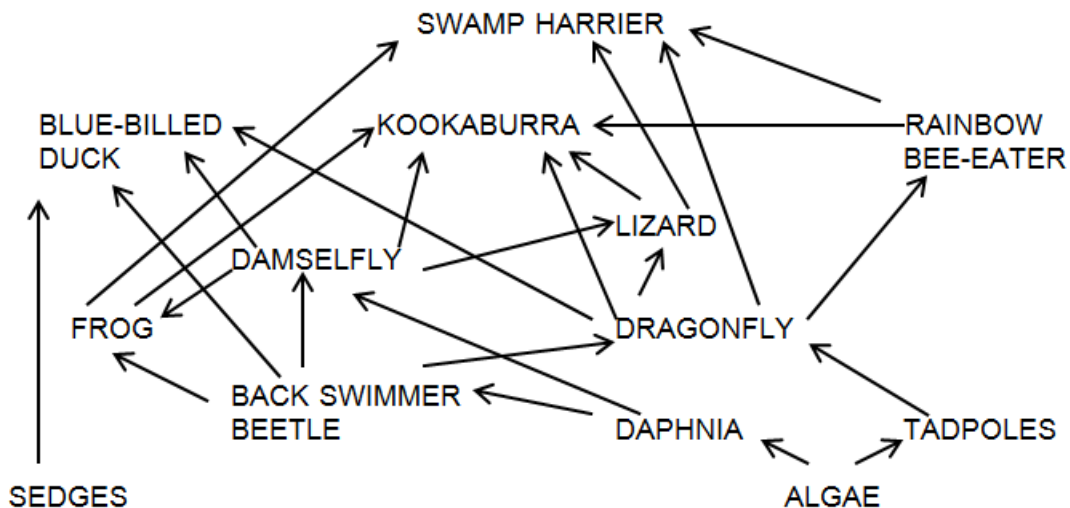
(a)   What do the arrows shown on the food web represent? (1 mark)

(b)   Identify the producers in this food web. (1 mark)

(c)   Identify **two (2)** organisms in the food web that are both second and third order consumers. (2 marks)

(d)   Explain the purpose of constructing a food web of a community.   (2 marks)

(e)   Identify the **two (2)** most important abiotic factors of this food web and explain why they are crucial to its survival.   (4 marks)

A new highway is constructed near the habitat in which the organisms of the food web live. Toxins from the construction and use of this new highway enter the water body following winter rains. As a result, both the dragonfly and damselfly populations are significantly reduced.

(e)   Describe the effect of reduced dragonfly and damselfly numbers on the populations shown in the food web.

(4 marks)

Question 27   **12 marks**

Wetlands are an important refuge for many organisms, both aquatic and terrestrial. Urbanisation and agricultural development have had negative impacts on wetland ecosystems throughout Australia.

(a)   Explain how wetland ecosystems have been changed as a result of;

(i) Urbanisation.   (2 marks)

(ii) Agricultural development and practices.   (2 marks)

(b)   Define 'eutrophication'.   (2 marks)

(c)   Describe the effect of eutrophication on the ongoing health of a wetland in the absence of any environmental management plan.   (4 marks)

(d)   Suggest **two (2)** management strategies for the prevention or rehabilitation of degraded
      wetland ecosystems.   (2 marks)

Question 28　　　　　　　　　　　　　　　　　　　　　　　　**20 marks**

The Honey possum (*Tarsipes rostratus*) is a tiny marsupial that inhabits the Banksia woodlands of southwest Western Australia. The Honey possum is nocturnal and feeds on the nectar and pollen from several species of *Banksia* and *Grevillea*, along with some low growing Eucalypts. They are able to travel up to 500 metres during a single evening. Honey possums move quickly between plants during feeding sessions to reduce time spent on the ground.

(a)　Identify the ecological benefits of the Honey possum's feeding habits.　　(3 marks)

(b)　Describe the relationship that exists between the Honey possum and the floral species from which they feed.　　　　　　　　　　　　　　　　　　　　　　　(2 marks)

(c)　How can nocturnal behaviour increase the possum's chance of survival?　　(2 marks)

(d)　Describe and explain **three (3)** major threats to the Honey possum's population and distribution.
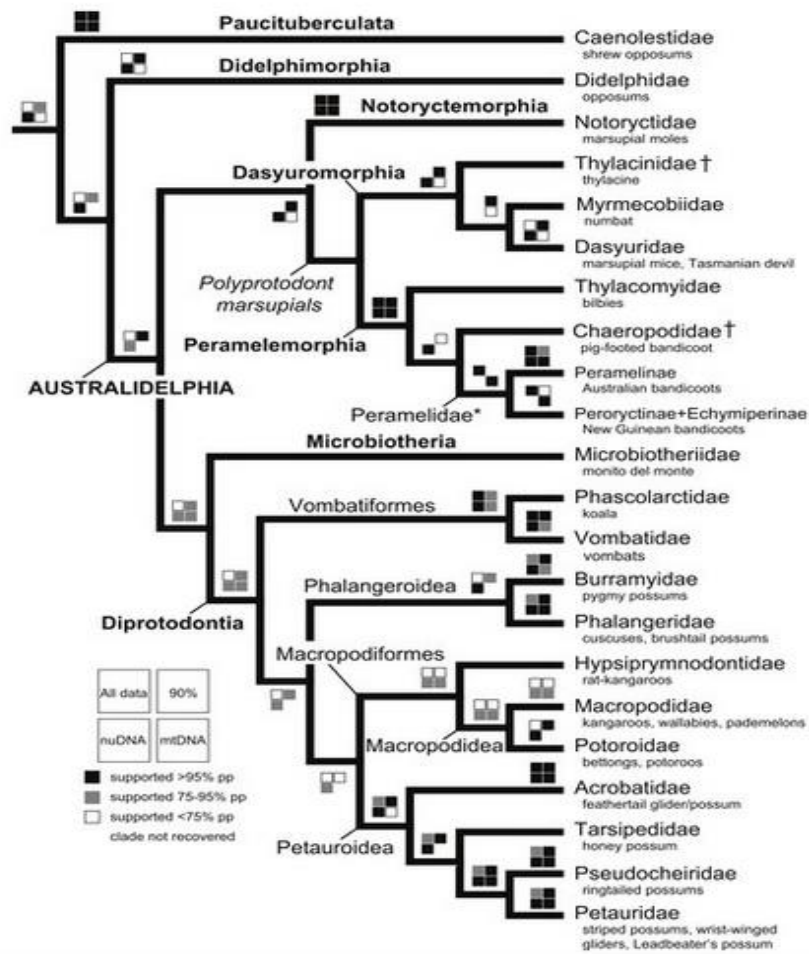
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(6 marks)

The Honey possum is classified as the sole species of the family Tarsipedidae. Its relationship to other marsupials is shown in the phylogenetic tree below.

(e) Explain what phylogenetic trees are used to represent. (2 marks)

(f) Outline the **three** (3) assumptions made when a scientist constructs a phylogenetic tree.
(3 marks)

(g)   Identify the Honey possum's most distant relative, including the family and order. (2 marks)

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Question 29　　　　　　　　　　　　　　　　　　　　　　**17 marks**

Abalone is a marine mollusc that is highly prized by both commercial and recreational fishers. In the past five years, the abundance of Roe's abalone (*Haliotis roei*) has severely declined in the West Coast Zone (Busselton Jetty to Greenough River mouth). Researchers have found that this decline coincided with an unusually warm Leeuwin current that affected the recruitment of larval abalone.

(a)　Define the term 'population'.　　　　　　　　　　　　　　　　　(1 mark)

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(b)　Describe and explain **two** (2) management strategies put in place by appropriate government agencies to protect the West Coast Zone abalone populations from further decline.

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(c)　Describe how Fisheries' scientists sample the population to measure the abundance of abalone in a given area.　　　　　　　　　　　　　　　(4 marks)

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(d)   Calculate the average density of an abalone population from the data presented in the
        table below.   (2 marks)

Table 1: Number of abalone found in sample sites taken from a coastal marine area 200m^2.

Sample	Number per 2m^2	Sample site observations
1	3	Sandy bottom.
2	7	Shallow reef.
3	23	Reef shelf.
4	11	Half reef, half sand.
5	9	Shallow reef.
6	5	Sandy bottom.
7	17	Reef shelf.
8	14	Reef shelf.
9	2	Half shallow reef, half sand.
10	21	Reef shelf.

In natural environments, the distribution of organisms is based on their needs.

(e)   Complete the table below regarding the **three (3)** different patterns of population
        distribution. Include an example for each pattern and explain why the organism is
        distributed in this manner.   (6 marks)

Pattern	Description	Explanation with example
Clumped		
Uniform		
Random		

14

Question 30 **20 marks**

(a) Define 'dichotomous key'. (2 marks)

(b) Explain how the classification of organisms can assist environmental scientists in the development of appropriate conservation strategies. (3 marks)
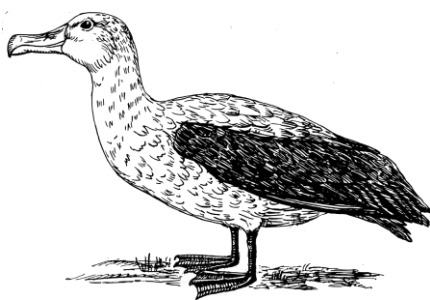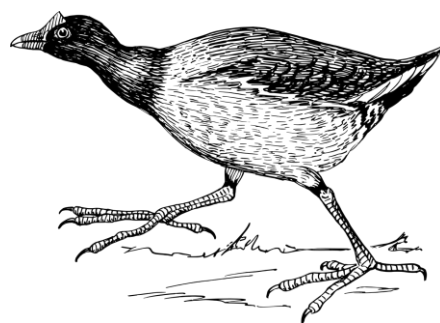
(c) Construct a simple dichotomous key, using yes and no questions, for the water bird species in the images below. (6 marks)
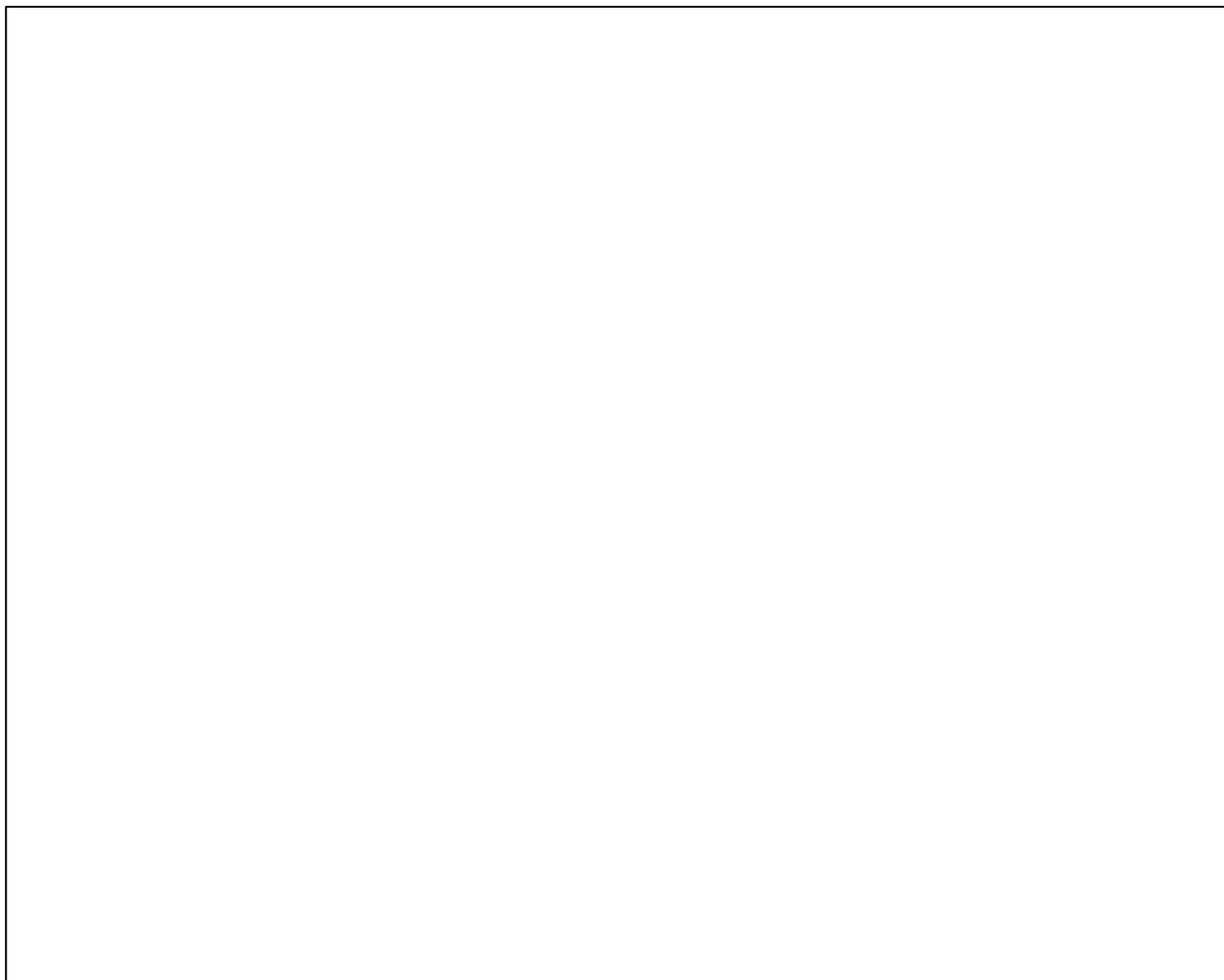

Species 1

Species 2

Species 3

Species 4

Draw the dichotomous key in the space below.

During breeding season, the black swan often builds large nests in shallow wetlands. The top of the nest sits approximately 30cm above the waterline. A researcher investigated the number of swan nests constructed in seasonal wetlands of southwest Western Australia. The wetlands cover patches of land within cattle grazing paddocks that are inundated during the winter months. The table below shows rainfall and nest data collected over an eight-year period.

Table 2: Swan nest numbers and rainfall data from wetlands of southwest Western Australia.

Year	Average annual rainfall (mm)	Number of nests in wetlands
2005	628	28
2006	601	25
2007	550	20
2008	567	21
2009	515	21
2010	502	16
2011	469	12
2012	441	10

(d)   Construct a graph to show the relationship between the number of swan nests and average, annual rainfall.   (5 marks)
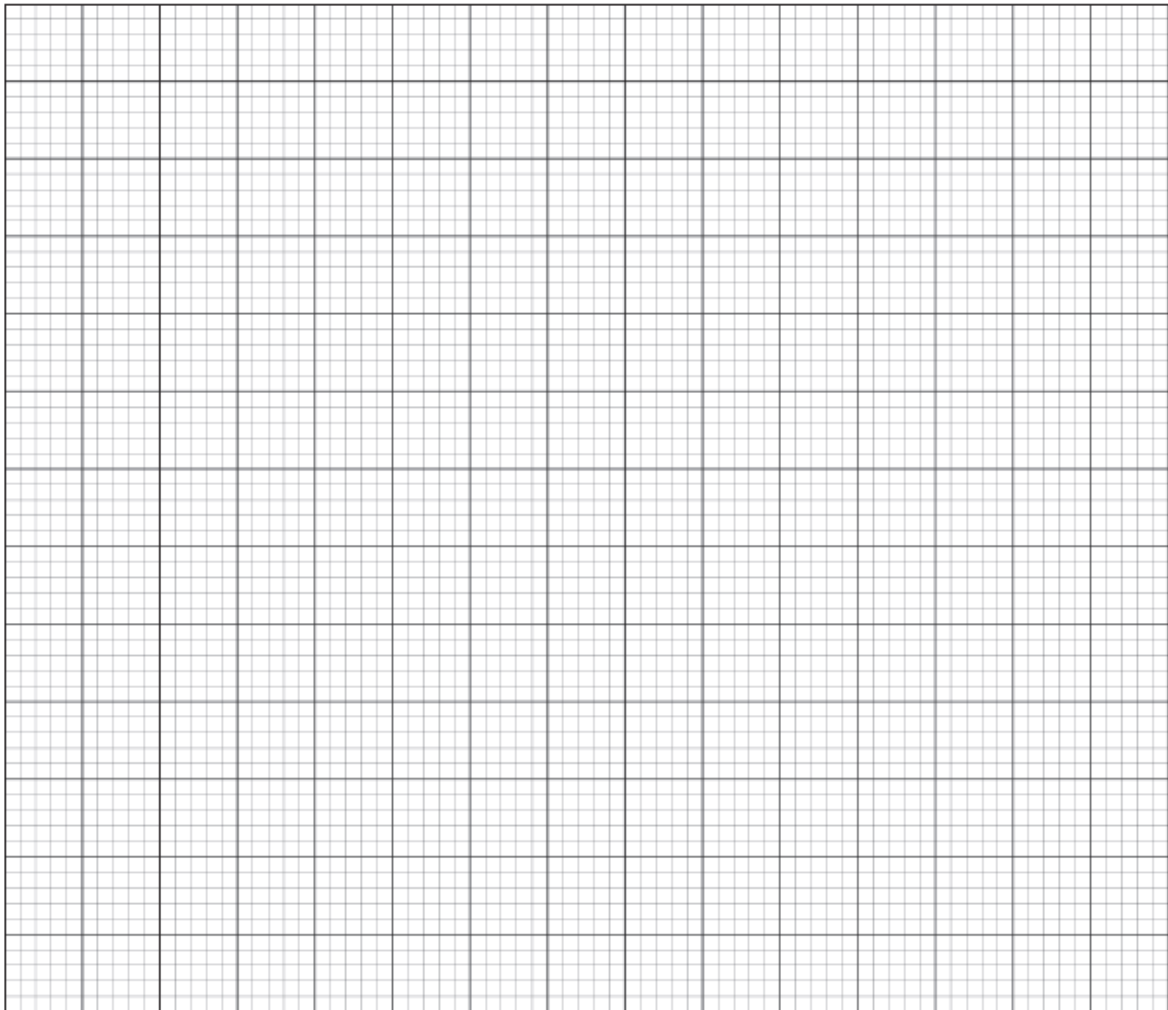
(e)   Describe the relationship shown by the graph.   (2 marks)

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(f)   Explain **two (2)** limitations in the collection of data for this investigation.   (2 marks)

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End of Section Two

Section Three: Extended answer   **10% (20 marks)**

This section contains **four (4)** questions. You must answer **two (2)** questions; **one** question **(1)** from Part A and **one** question **(1)** from Part B.

Use a black or blue pen for this section. Only graphs and diagrams may be drawn in pencil. Responses can include: labelled diagram with explanatory notes; lists of points with linking sentences; labelled tables and/or graphs; and/or annotated flow diagrams with introductory notes.

Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.

Suggested working time: 35 minutes

Part A

Choose **either** Question 31 **or** Question 32.

| | **Question 31** | **10 marks** |

Discuss how scientists classify ecosystems based on their biotic and abiotic factors.

OR

| | **Question 32** | **10 marks** |

Compare and contrast the process of primary and secondary succession.

Question number_____

Part B

Choose **either** Question 33 **or** Question 34.

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

☐ **Question 33** **10 marks**

Describe the role of 'keystone species' in a community. Explain how the concept of 'keystone species' has influenced the development of conservation strategies.

OR

☐ **Question 34** **10 marks**

"*A healthy soil environment provides the foundation for maintaining the biodiversity of terrestrial ecosystems*".

Justify this statement using your knowledge and understanding of ecosystem dynamics.

Question number_____

Additional graph paper