

Question 1**(19 marks)**

David grows mangoes on his farm near the Moore River. While he was overseas on a holiday, he visited an aquarium shop and recognised one of the fish on sale. It was a *tandanus bostocki*, better known as a freshwater cobbler. He was surprised that it was selling for \$500 when the same fish was plentiful in the section of the Moore River that ran through his farm.

David's mangoes are not very profitable. He wondered whether it would be possible to both grow mangoes and breed cobblers for sale to the international aquarium market. All he would have to do was dig some deep canals from the river, running between the rows of mango trees. These canals would irrigate the trees, while also being used to hold the fish.

There would be some extra costs in buying food for the fish, but the waste products from the fish would be an excellent source of nutrients for the mango trees. It may also save him money by reducing the amount of fertiliser he would use on the trees.

David decided to carry out an investigation to find out whether the nutrients provided by the fish would actually benefit his mangoes. He selected five different rows of mango trees and dug a deep canal beside each row.

Each canal was stocked with different quantities of fish and steel grates were used to prevent them from escaping. When it came time to harvest the mangoes, he recorded the weight of mangoes from each row. The results are shown in the table below.

Rows of mango trees, numbers of fish and average weight of mangoes per tree

Row	Number of mango trees	Number of fish	Weight of mangoes harvested (kg)	Average weight of mangoes per tree (kg)
1	11	100	150	13.6
2	11	200	180	16.4
3	12	300	200	16.7
4	12	400	175	14.6
5	11	500	80	7.3

- (a) What was the independent variable in the investigation? (1 mark)

- (b) What was the dependent variable in the investigation? (1 mark)

- (c) Write a suitable hypothesis for the investigation. (2 marks)

- (f) David's daughter, Sue, is studying Integrated Science at school. Sue tells her father that his investigation was not well designed. Outline **three** improvements that Sue could have suggested to her father to enhance the investigation design. (3 marks)

One: _____

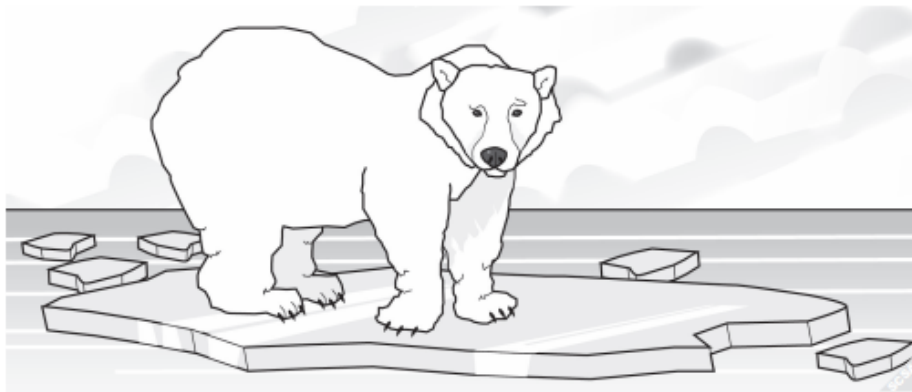
Two: _____

Three: _____

- (g) Describe **two** ethical issues that David should have considered before starting his investigation. (4 marks)

One: _____

Two: _____

Question 1**(18 marks)**

The Arctic region consists of large areas of pack ice with some large land masses that border the ice. The pack ice provides important habitats for a wide variety of creatures, but global warming (gradual heating of the Earth's surface, oceans and atmosphere) has seen the areas of pack ice reduced.

One animal that has been affected greatly is the polar bear, *Ursus maritimus*, one of the largest carnivores of the Arctic region. The reduction in the areas of pack ice has meant polar bears are confined to land more often, and their access to food is being cut off. Their ecological position is now classified as 'endangered'.

To stop their decline researchers investigated the idea of substituting their food supply. A food preparation containing seaweed (flavoured with fat to taste and smell like seal meat) was developed. Seaweed is known to provide a lot of protein. The preparation would be fed to bears when global warming cuts off access to sea ice.

To investigate the alternative food source, researchers monitored 100 polar bears in Northern Canada. The bears were enclosed in a large compound of five square kilometres. This was divided into two equal areas with 25 male bears and 25 female bears in each area.

One group of polar bears was fed seal meat and the other group was fed the seaweed food preparation. For two years, a team of researchers took three-monthly weight records of the polar bears to assess the impact of the two diets.

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- (a) (i) Name the independent variable and the dependent variable in this investigation. (2 marks)

Independent variable: _____

Dependent variable: _____

Question 1(a) (continued)

- (ii) Write an hypothesis for this investigation. (2 marks)

The researchers would have needed to apply for approval from a research ethics committee before conducting this research.

- (e) Name a factor in this investigation for which the researchers would have needed to seek approval. Explain the reason for the factor. (3 marks)
