



# **INTEGRATED SCIENCE**

## **GENERAL COURSE**

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Question 1

(19 marks)

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

(1 mark)

Description	Marks
Number of fish	1
<b>Total</b>	<b>1</b>
Note: do not accept just "fish"	

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

(1 mark)

Description	Marks
The weight of mangoes harvested	1
<b>Total</b>	<b>1</b>

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

(2 marks)

Description	Marks
Hypothesis showing the relationship between independent and dependent variables	2
Statement made about fish stock and/or weight of mangoes harvested	1
<b>Total</b>	<b>2</b>
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>an increase in the number of fish stocked in each canal will result in an increase in the weight of mangoes harvested</li> </ul>	

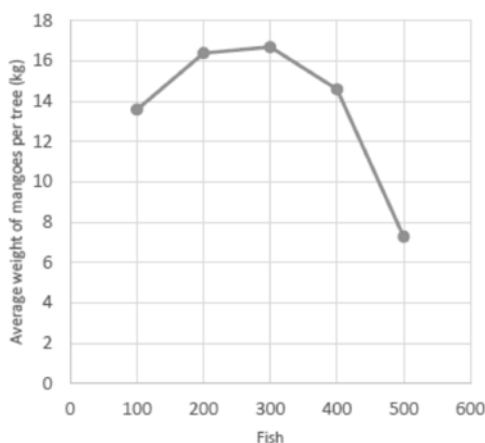
- (d) Using the data from the table, draw a line graph comparing the average weight of mangoes per tree and the number of fish stocked.

(4 marks)

Description	Marks
Title appropriate with both independent and dependent variable included	1
X-axis correctly labelled with a linear scale and units	1
Y-axis correctly labelled with a linear scale and units	1
Correctly plot points.	1
<b>Total</b>	<b>4</b>

Answers may include, but are not limited to the following:

Title: Average weight of mangoes per tree verses the number of fish



- (e) David wants to maximise the total weight of mangoes he harvests. Use the graph you have drawn to work out the **best** number of fish to stock in each canal. In your answer, explain the relationship between the average weight of mangoes per tree and the number of fish. (4 marks)

Description	Marks
Using the graph, the optimum number of fish is around 300.	1
Explains clearly the relationship between the weight of mangoes harvested and the number of fish stocked, including nutrient levels	3
Outlines the relationship between the weight of mangoes harvested and the number of fish stocked	2
States some relevant information about the weight of mangoes harvested and/or the number of fish stocked	1
<b>Total</b>	<b>4</b>
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>an increase in the number of fish stocked (increase in nutrient levels for the mango trees) to around 300 will increase the weight of mangoes harvested after that increasing fish stock will decrease the weight of mangoes harvested (possible due to an oversupply of nutrients being harmful to the mango trees).</li> </ul>	

- (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)

Description	Marks
One mark for each improvement. Maximum of three marks.	
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>add a control group with zero fish</li> <li>the number of trees per row should have been kept constant (controlled variable)</li> <li>do more trials (lacks reliability)</li> <li>look at factors such as size of mangoes, quality of mangoes, (or other examples of measure of dependent variable)</li> <li>control the size of fish or other 'controlled variables' not accounted for.</li> </ul>	1–3
<b>Total</b>	<b>3</b>

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

Description	Marks
Two marks for each ethical issue. Maximum of four marks.	
Describes clearly an ethical issue	2
States an ethical issue	1
<b>Total</b>	<b>4</b>
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>well-being of fish – habitat conditions in canals</li> <li>release of additional nutrients to river (fish food or waste, agricultural runoff)</li> <li>impact on water aquifers, etc through nutrients leaching</li> <li>other damage to river environment or surrounding environment.</li> </ul>	

Question 2

(19 marks)

- (a) Based on the information above, complete this food web to include the mosquito fish. (2 marks)

Description	Marks
Mosquito fish eating zooplankton and marron - arrow correct direction	1
Mosquito fish being eaten by turtles – arrow correct direction	1
<b>Total</b>	<b>2</b>

- (b) From the food web, draw a food chain that includes at least four organisms. (2 marks)

Description	Marks
Any valid food chain which includes four or more organisms	2
Valid food chain but arrows in wrong direction	1
<b>Total</b>	<b>2</b>
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>• rushes → insects → pigmy perch → turtles</li> <li>• detritus → zooplankton → insects → pigmy perch → turtles</li> <li>• phytoplankton → zooplankton → insects → pigmy perch → turtles</li> </ul>	

- (c) Do you think the population of cobblers would increase, decrease or stay the same after the introduction of mosquito fish? Explain your answer. (3 marks)

Description	Marks
Decrease	1
Explains clearly the reason is competition for a food source - marron	2
States information about a decrease in food source	1
<b>Total</b>	<b>3</b>

- (d) Using your food web, predict **two** effects that the mosquito fish might have on organisms in the web other than the cobbler. (2 marks)

Description	Marks
One mark for each effect.	
Answers may include, but are not limited to the following: <ul style="list-style-type: none"> <li>• marron population falls</li> <li>• zooplankton population falls</li> <li>• turtle population increases</li> </ul>	1–2
<b>Total</b>	<b>2</b>

- (e) On the basis of your knowledge of how energy transfers through a food chain, explain why such chains are rarely longer than four or five organisms. (4 marks)

Description	Marks
Explains clearly that energy is lost at each level in food chains leaving very little (10%) for use at the next trophic level	4
Explains that energy is lost at each level in food chains leaving less for use at the next trophic level	3
Outlines that energy is lost at each level in food chains	2
States that energy is lost in food chains	1
<b>Total</b>	<b>4</b>
<p>Answers may include, but are not limited to the following:</p> <ul style="list-style-type: none"> <li>energy enters the system through the producers and therefore the amount energy in the system is determined by the producers. Energy transfers from one trophic level to the next and energy is lost at each level. Approximately 90% is lost (usually as heat or due to metabolic activity). Therefore insufficient energy remains for higher levels (as only 10% is available to next trophic level).</li> </ul>	

- (f) Name **two** abiotic factors in this river system that might be altered by human activity. Explain how these changes could affect the ecosystem. (6 marks)

Description	Marks
Three marks for each abiotic factor. Maximum six marks.	
Names a feasible abiotic factor	1
Explains clearly how the changes impact on the ecosystem	2
States some relevant information about how the changes impact on the ecosystem	1
<b>Total</b>	<b>6</b>
<p>Answers may include, but are not limited to the following:</p> <ul style="list-style-type: none"> <li>temperature decrease in aquatic organisms that are not temperature tolerant</li> <li>pH decrease in aquatic organisms that are not pH tolerant</li> <li>water levels due to damming or irrigation usage increase in aquatic organisms that favour still water decrease in aquatic organisms that favour flowing water</li> <li>salinity reduction in non-salt tolerant plants, reduction in non-salt tolerant aquatic animals migration of salt tolerant organisms from estuary into river system</li> <li>nutrient levels encourage growth of algae, eutrophication, etc.</li> <li>turbidity impact on photosynthetic organisms, energy in ecosystem.</li> </ul>	

