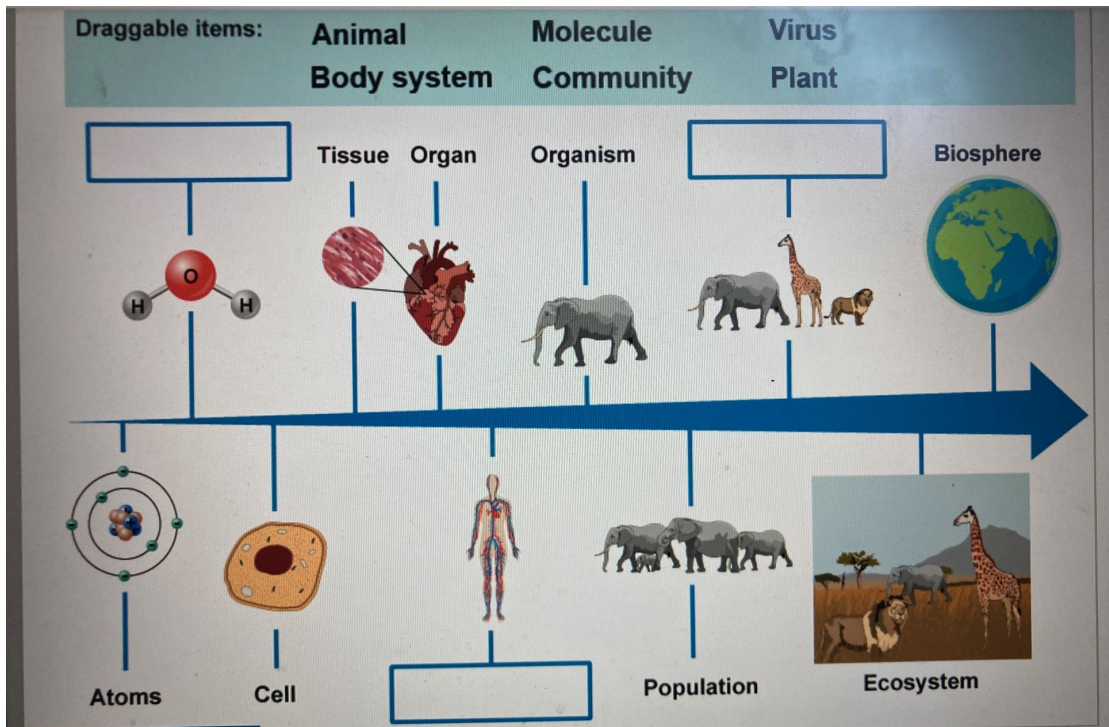


Question 1 (8 marks)

Question 1a (1 mark)

Select the correct terms and drag and drop them to complete the diagram.



Question 1b (2 marks)

Organize the terms to the correct location in the diagram below.

Draggable items:

- Large central vacuole
- Cell membrane
- Nucleus
- Cell wall
- Small vacuole
- Mitochondria
- Chloroplast

Question 1c (3 marks)

Organelles are the specialized parts of cells that have a specific function. Using scientific language, **outline** the function of mitochondria.

B I Ω Σ Styles

Question 1d (2 marks)

Mitochondria have several folds as shown in the image below.

Outline how the structure of mitochondria is specifically adapted to the function.

B I ← → U x_e x² ∑ Ω Σ Styles ↵

Question 2 (7 marks)

In mitosis, two identical cells are produced from a parent cell. Mitosis is needed for many life functions.

Question 2a (1 mark)

Select all the functions of mitosis from the following list.

- Growth
- Sexual reproduction
- Respiration
- Metabolism
- Repair
- Asexual reproduction

Question 2b (2 marks)

We have seen in part (a) that new cells can form through the process of mitosis. Meiosis is another process which forms new cells.

Outline the differences in the **cells** produced in meiosis and mitosis.

B I ← → U x_e x² ∑ Ω Σ Styles ↵

Question 2c (4 marks)

The total available genes in a population is called the gene pool.

Describe two sources of genetic variation in a gene pool.

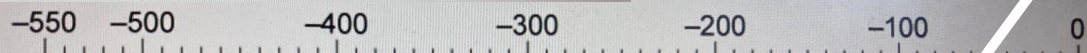
B I ← → U x_e x² ∑ Ω Σ Styles ↵

Question 3 (10 marks)

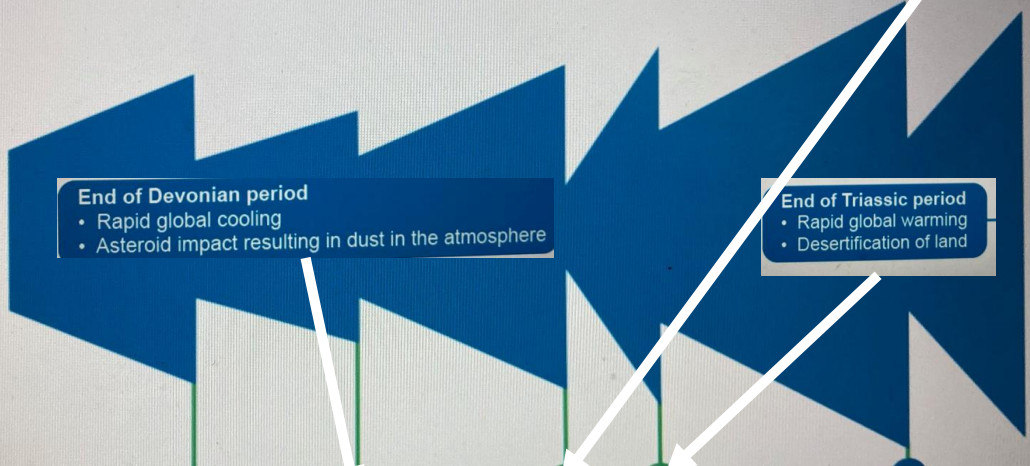
Catastrophic, global events or widespread, rapid environmental change can cause mass extinctions. The image below shows five mass extinction events.

Mass Extinction Events

End of Permian period
• Volcanic activity resulting in greenhouse gases
• Rapid global warming



Bar width represents number of living animal species



End of Devonian period
• Rapid global cooling
• Asteroid impact resulting in dust in the atmosphere

End of Triassic period
• Rapid global warming
• Desertification of land

End of Ordovician period
• Rapid global cooling
• Falling ocean levels

End of Cretaceous period
• Asteroid impact resulting in dust in the atmosphere
• Falling ocean levels

Question 3a (2 marks)

Suggest a difference between the meaning of the terms *extinction* and *mass extinction*.

B I ← → U x₂ x² ∑ Ω Σ Styles ↕

Question 3b (2 marks)

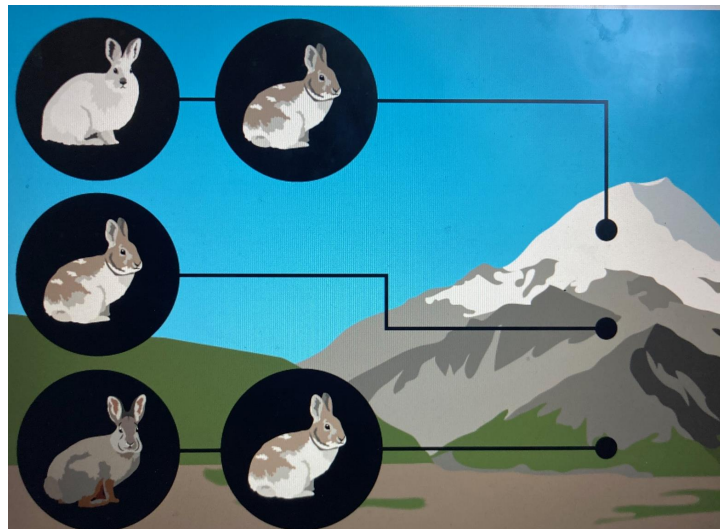
Individual species are in danger of extinction when genetic diversity is low or population sizes are small. **Outline** how population size in a species can decrease.

B I ← → U x₂ x² ∑ Ω Σ Styles ↕

Question 3c (2 marks)

At the end of the Cretaceous period an asteroid impact resulted in rapid global cooling and falling ocean levels. **Suggest** two traits that helped mammals to survive in the new environmental conditions.

B I ← → U x₂ x² ∑ Ω Σ Styles ↕



Question 3d (4 marks)

Rabbits are an example of a species that has different colours of fur. In a population of mountain rabbits, rabbits with white fur are far more common in the snowy upper areas of the mountain. Rabbits with darker fur are far more common at lower levels. The mixed coloured rabbits are found in height ranges overlapping the others.

Use the theory of natural selection to **explain** this distribution of rabbits with different coloured fur.

B *I* ← → U x_2 x^2 Ω Σ Styles

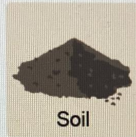
Question 4 (11 marks)

Changes in population size of living organisms are dependent on biotic and abiotic factors. For plants, this includes sunlight, temperature and the availability of nutrients.

Question 4a (1 mark)

Select the correct category for each of the following factors.

Draggable items:



Biotic

Abiotic

Question 4b (2 marks)

The process of photosynthesis captures energy from the sun for use by plants and animals. Select the correct words to complete the word equation for photosynthesis.

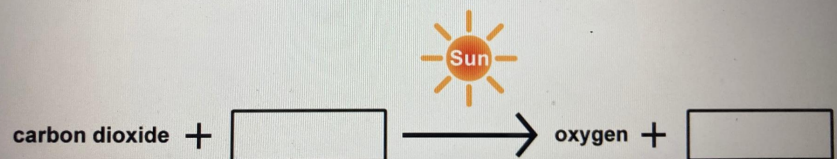
Draggable items:

water

carbon

glucose

air



Question 4c (1 mark)

In preparation for an ecology field trip, a class had been learning about what nutrients a plant needs for growth and photosynthesis. The students learned that one of the nutrients that plants need is nitrogen. Nitrogen for plants can come from many sources including fertilizers, lightning, and bacteria.

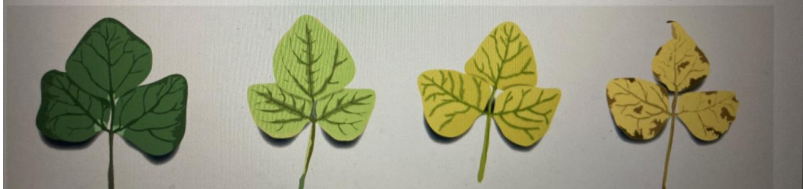
Before the trip the students conducted a laboratory experiment using fertilizer containing nitrogen to grow pea plants. The students' hypothesis was:







If fertilizer containing nitrogen is added to the soil, then the pea plants will grow taller because there is more nitrogen which is an essential nutrient.

The students collected the following data after the plants had been growing for two weeks:

Trial	Height of plant after two weeks / mm	
	Fertilizer added to soil	No fertilizer added to soil
1	310	196
2	347	228
3	332	222

The students also used the following image to compare the leaves of the plants.



Trial	Colour of leaves taken from each plant			
	Fertilizer added to soil		No fertilizer added to soil	
1	Dark green and crisp edges		Yellow and dry edges	
2	Bright green and waxy surface		Brownish yellow	
3	Dark green and waxy surface		Light green and brown edges	

Using the information in the tables, **state** the independent variable.

B I ← → x_2 x^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ Styles

Question 4d (1 mark)

State one dependent variable recorded by the students.

B I ← → x_2 x^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ Styles



Question 4e (2 marks)

The students recorded both quantitative and qualitative data. **State** the features of quantitative data and qualitative data.



Quantitative data

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{6}$ | Ω Σ | Styles ▾ |

Qualitative data

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{6}$ | Ω Σ | Styles ▾ |



Question 4f (2 marks)

Calculate the mean for the height of the plants with fertilizer added. Give your calculated value to an appropriate number of decimal places.

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{6}$ | Ω Σ | Styles ▾ |



Question 4g (2 marks)

Using the data in the tables above, **outline** the validity of the students' method giving both a strength and a limitation.

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{6}$ | Ω Σ | Styles ▾ |

Question 5 (14 marks)

While on the field trip, the students noticed two ponds of approximately the same size that had green plants floating on the surface of the pond. The instructor pointed out that these were duckweed plants, small water plants whose leaves float on the surface of the pond and whose roots hang down below. The image below shows a duckweed plant.



One of the ponds had very few duckweed plants and was surrounded by trees that were shading the pond. The surface of the other pond was mostly covered in duckweed and was in full sun. No trees were shading its surface.

The students wondered if light was a factor in the growth of the plants. They decided to collect duckweed plants to bring back to their school's science lab and grow them under experimental conditions. The students chose the dependent variable to be the final number of duckweed plants. They then planned to calculate the change in number of duckweed plants.

Design an investigation that would allow them to obtain quantitative data. In your answer, you should:

- identify the independent variable and two control variables
- formulate a testable hypothesis with a scientific explanation
- describe how to manipulate, measure or monitor all of the variables
- describe the method to collect sufficient data
- list any safety considerations.

Question 6 (18 marks)

The students analysed their results and wondered if instead of the amount of sunlight reaching the pond, it was actually the difference in temperature due to shading that was affecting the growth of the duckweed. They set up an experiment to ensure the duckweed plants received the same amount of light, but at different temperatures. The duckweed was placed in water baths to maintain the water at constant temperature.

Select the correct location for each step in the method.

Draggable items:

Place lamp facing water bath

Count final number of duckweed plants and record values

Select equally healthy duckweed plants

1. Collect duckweed plants from pond
2. [Redacted]
3. Label beakers
4. Measure water from pond into each 500 cm³ beaker
5. Count initial duckweed plants and place 10 duckweed plants into each of 24 beakers
6. Set the temperature of each water bath
7. Add thermometer to water bath
8. [Redacted]
9. Place three beakers with samples into each water bath
10. Wait two weeks
11. [Redacted]

Question 6b (2 marks)

Suggest one improvement to the method. **Justify** your answer.

B **I** **↔** **↔** **U** **x₂** **x²** **≡** **≡** **Ω** **Σ** **Styles** **↕**

Question 6c (6 marks)

The table below shows the students' mean data.

Temperature / °C	Mean number of plants
7.5	20
10.0	28
12.5	40
15.0	50
20.0	70
27.5	80
30.0	70
37.5	18

Plot a graph of the data.

Draggable: ◆

Question 7 (8 marks)

Waste water contains nitrogen and phosphorus from human waste, food and other contaminants such as heavy metals, soaps and detergents. Some students have heard of plants being used to treat waste water and they wanted to investigate if a plant called water hyacinth could be used in this way.



Water hyacinth


- 60–80 % nitrogen removal
- Rapid growth rate, up to 5 m per day
- Good uptake of heavy metals: lead, copper, cadmium and mercury
- Ideal temperature range: 21–30°C
- Highly invasive when outside of its native area

The students' research question was:

Does adding water hyacinth to waste water help to remove contaminants?

Question 7a (3 marks)


Use the research question above to **formulate** a hypothesis for the students' investigation.

B I ← → x₂ x² \int \sum Ω Σ Styles 


Question 7b (2 marks)

State two control variables for this investigation.

Control variable 1

B I ← → x₂ x² \int \sum Ω Σ Styles 

Control variable 2

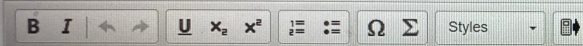
B I ← → x₂ x² \int \sum Ω Σ Styles 



Question 7c (2 marks)

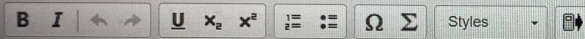
After the investigation, the students realized that the starting amount of nitrogen was different for each trial.

Outline how this limitation would have affected the results.



Question 7d (1 mark)

State an action which would improve the limitation in part (c). Include details of any equipment you would use.



Question 8 (8 marks)

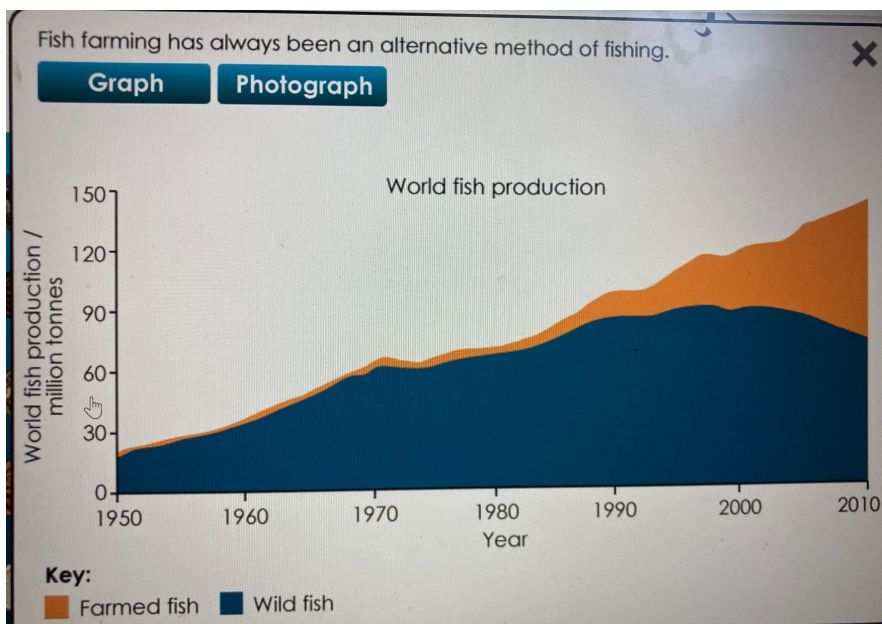
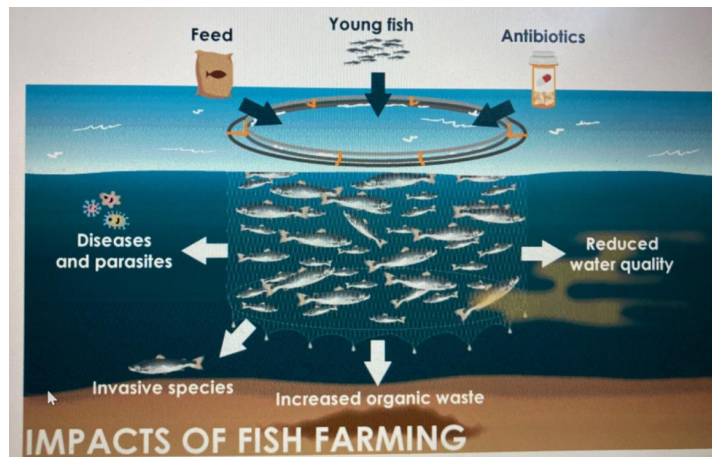
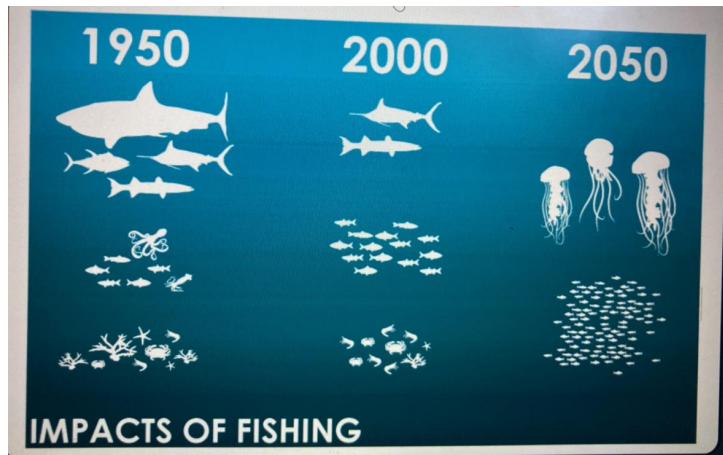
Fish are an important part of many diets around the world. As the human population is increasing, the amount of fish eaten per person is also increasing. This increase in demand for fish has led to unsustainable fishing practices. Decreasing fish populations are a world-wide problem threatening food supplies. It is important to create a fair solution to ensure that everyone has access to adequate food supplies without damaging ecosystems.

The interactive graphic below gives some information to support this task.

This media is interactive

Click on the headings on the left to show the information.

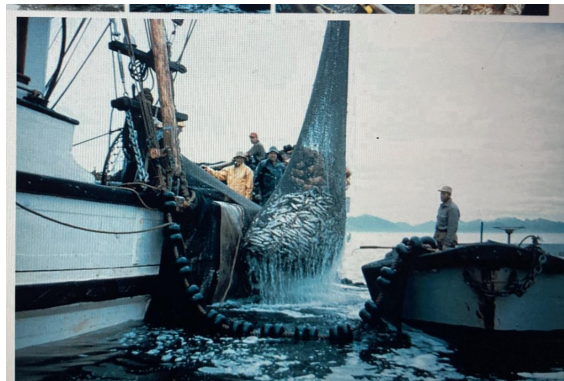





Fishing looks different in different parts of the world. One way the increasing demand for food is being met is by using technology to catch more fish.



Hover over the photos above to see a larger version.



Genetic modification allows farmers to grow bigger fish. ✕



<p>Genetically modified farmed salmon</p> <p>Length = 60 cm Mass = 3.0 kg</p>	<p>Farmed salmon</p> <p>Length = 33 cm Mass = 1.3 kg</p>
--	---

*Both fish are 18 months of age

Question 8a (1 mark)

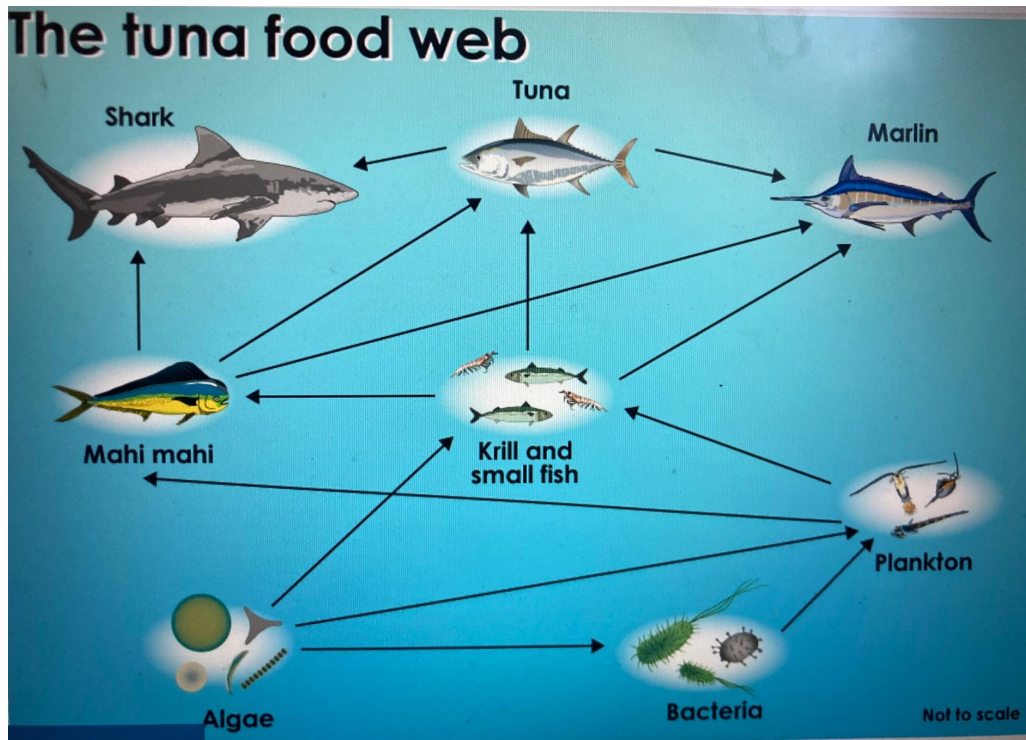
Use the interactive graphic to **state** one reason for a decrease in the total number of wild fish since 1950.

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ | Ω Σ | Styles |

Question 8b (2 marks)

Suggest how technology has allowed more fish to be caught.

B I | ← → | x₂ x² | $\frac{1}{2}$ $\frac{3}{4}$ | Ω Σ | Styles |



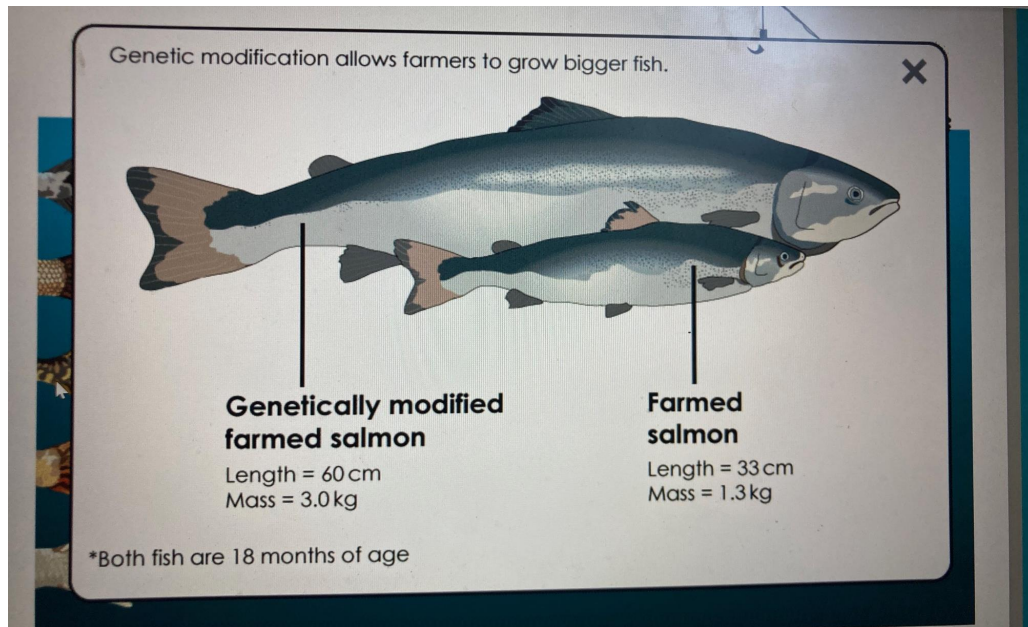
Question 8c (5 marks)

The use of technology will have an impact on the food webs in an ecosystem. The food web below shows the transfer of energy in an aquatic ecosystem.

Using scientific language, **describe** the impact on two organisms in the ecosystem if the number of tuna is reduced.











B I ← → **U** x_n x^2 **Ω** **Σ** Styles **↕**

Scientists are currently working to develop genetically modified fish in order to meet the world demand for fish. A genetically modified salmon that can grow faster than a traditional salmon has been developed and is currently being raised in fish farms. The faster a fish grows, the sooner it can be sold as food. Scientists hope to develop other genetically modified fish to supplement decreasing wild fish populations around the world.



Question 9a (2 marks)

Suggest an advantage and a disadvantage of farming genetically modified salmon.

B I          Styles 



Question 9b (14 marks)

Discuss and **evaluate** the use of genetically modified fish farming to solve the problem of decreasing fish stocks. In your answer, you should include:

- positive and negative environmental impacts of fish farms
- positive and negative economic or social impacts of fish farms
- a suggestion of the best location for fish farms with justification
- a concluding appraisal giving your opinion.

B **I** | ← → | **U** x_2 x^e | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕

☰ Scroll down to continue