May 2019
Biol

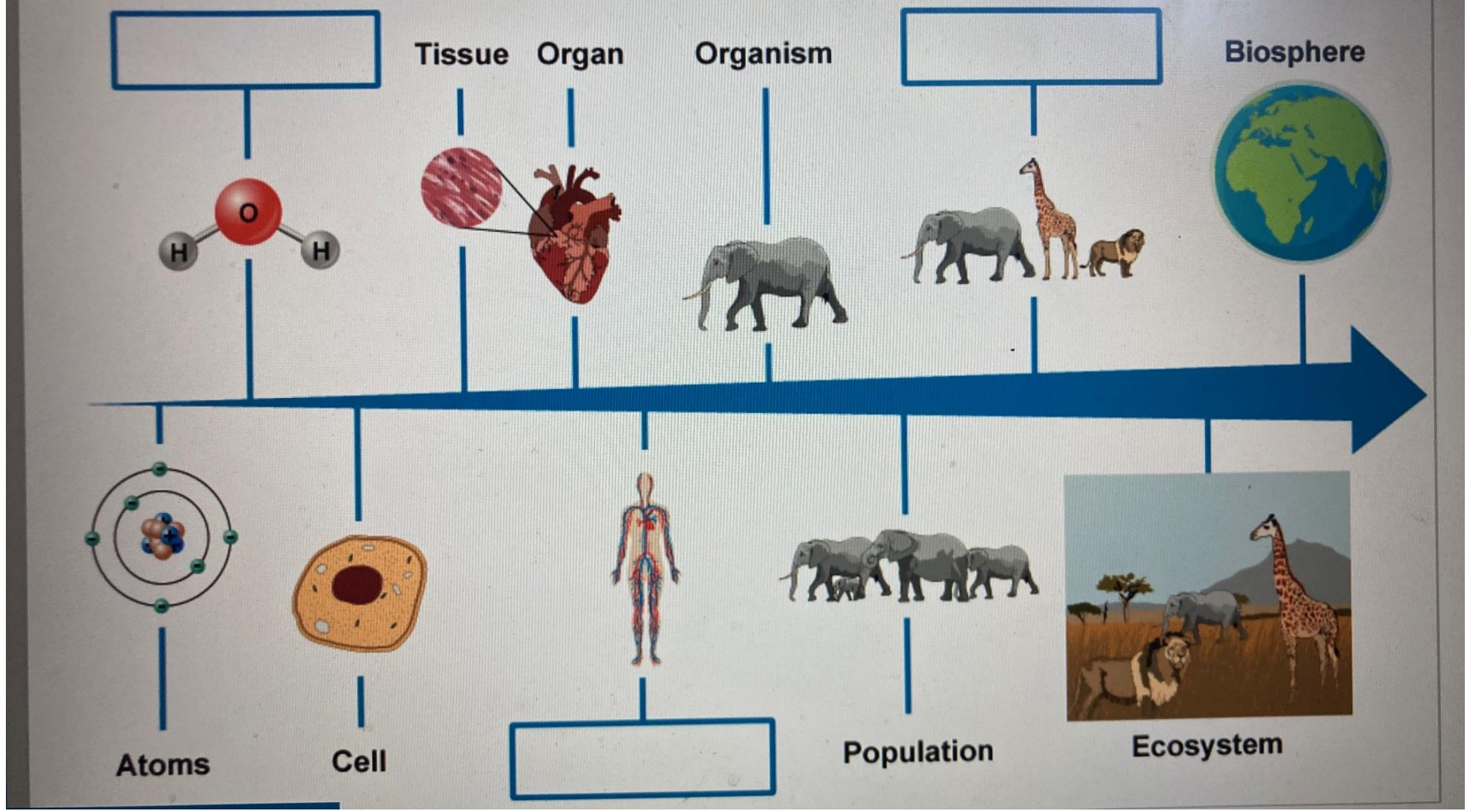
Question 1 (8 marks)

Question 1a (1 mark)

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

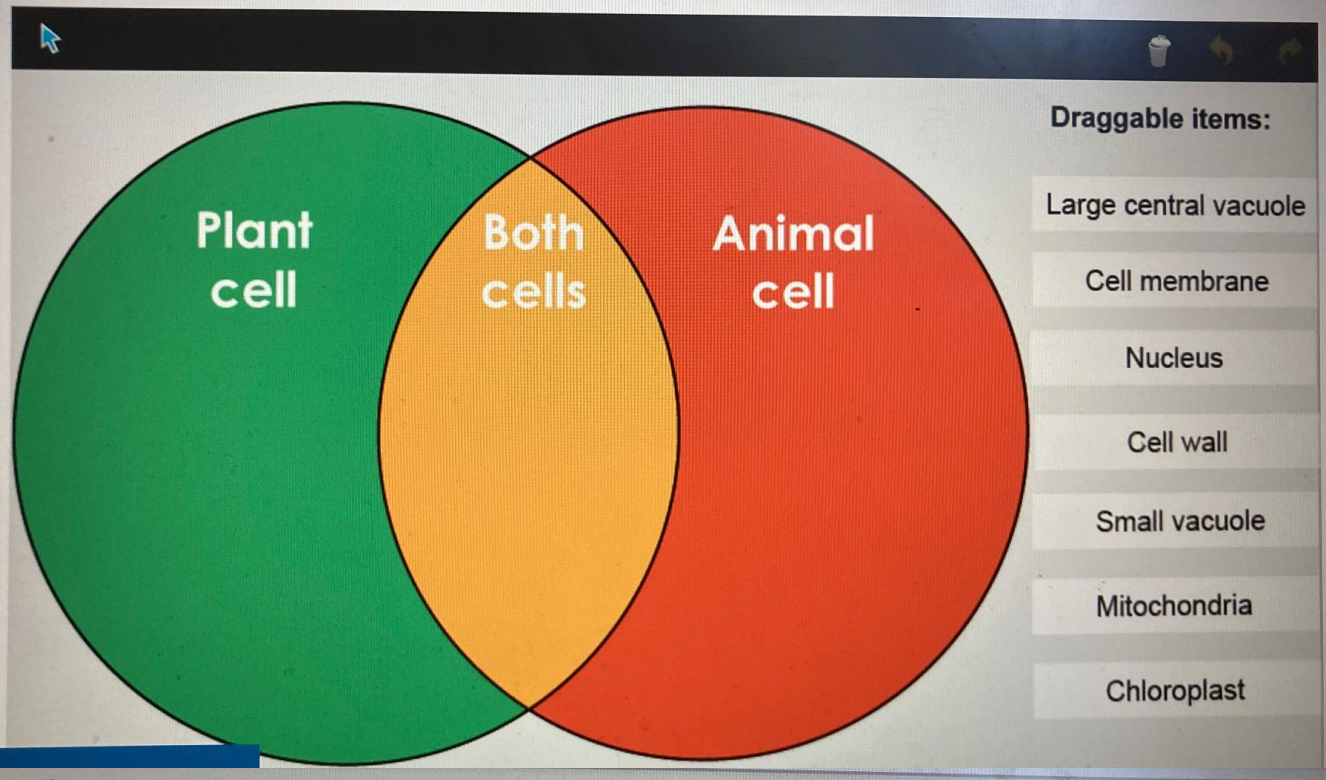
Draggable items:

- Animal
- Body system
- Molecule
- Community
- Virus
- Plant



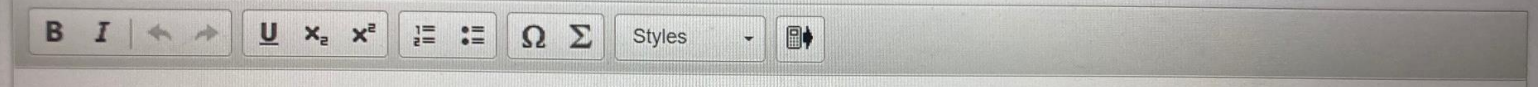
Question 1b (2 marks)

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



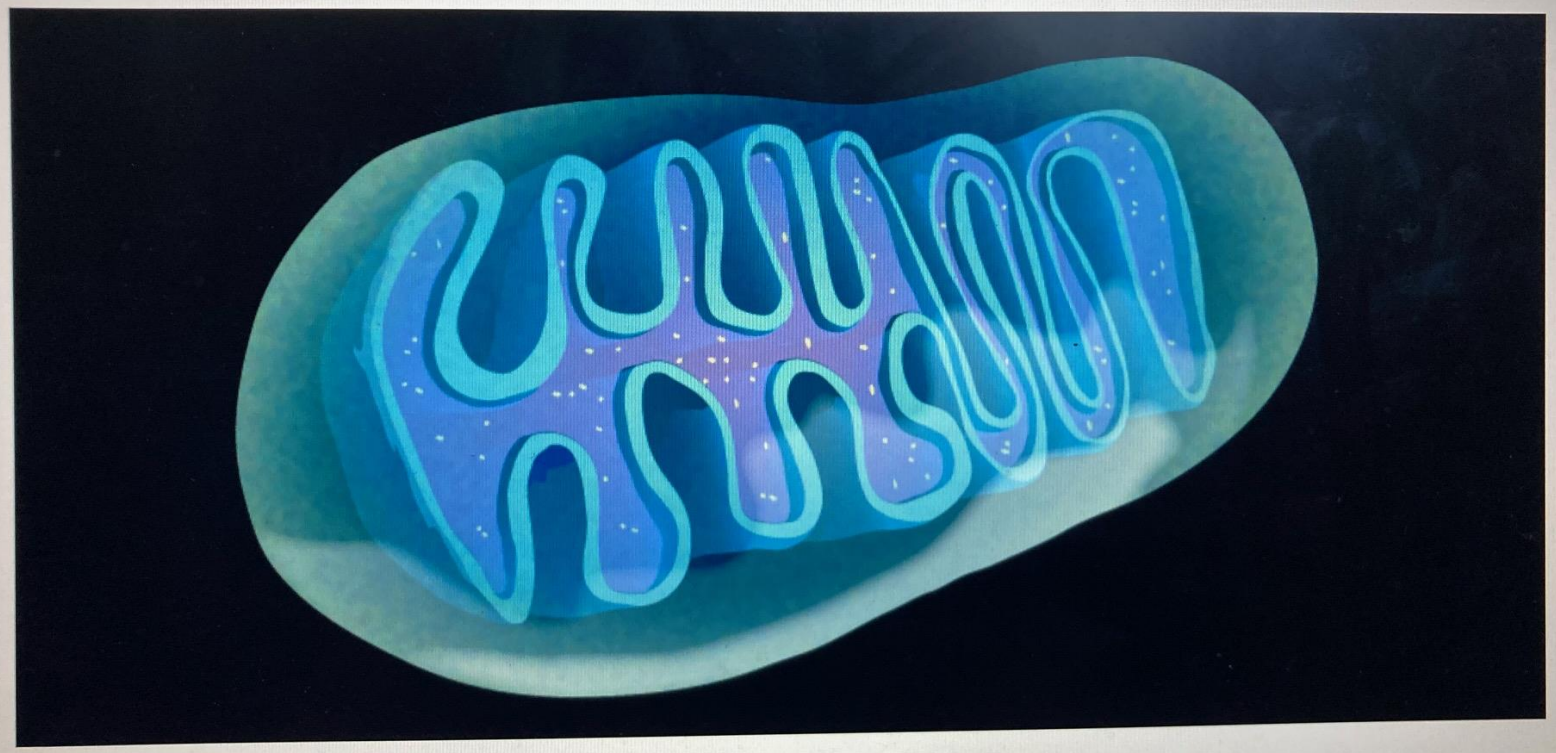
Question 1c (3 marks)

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



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_2 x^2 | 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.

- [x] Growth
- [ ] Sexual reproduction
- [ ] Respiration
- [ ] Metabolism
- [x] Repair
- [x] 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_2 x^2 Ω Σ Styles

While you end up with double the cells in both mitosis and meiosis

Question 2c (4 marks)

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

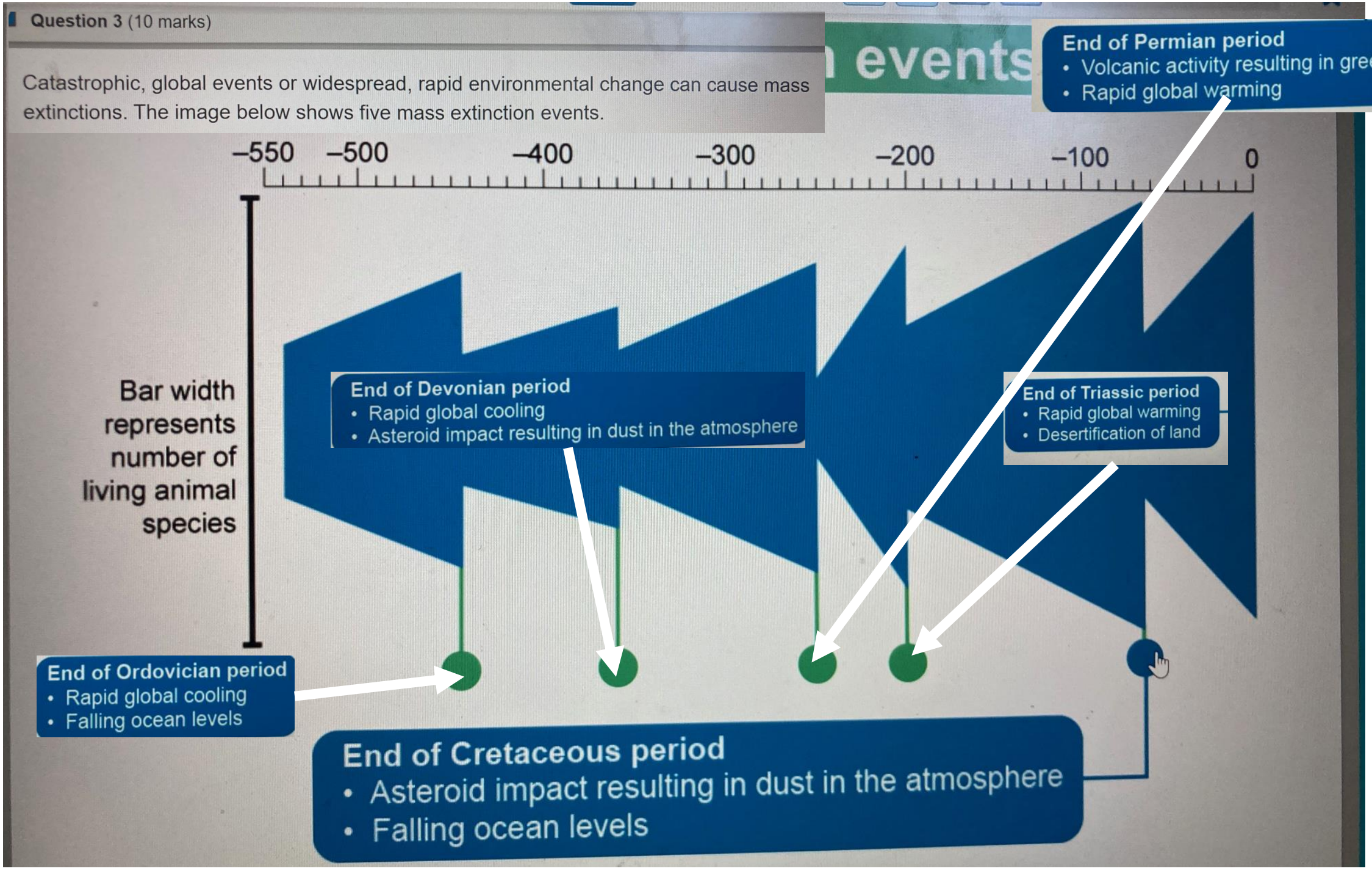
Describe two sources of genetic variation in a gene pool.

B I U x_2 x^2 Ω Σ Styles

Meiosis allows for the crossing over of genes and can cause genetic variation. This usually takes place in prophase of the mitotic phase.

Question 3 (10 marks)

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



Question 3a (2 marks)

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

Extinction is usually used to refer to as the wipe out of an individual species or a small group of them. However mass extinction refers to the wipe out of entire ecosystems or planets. They are the destruction of all life on a very large scale, usually the whole world.

Question 3b (2 marks)

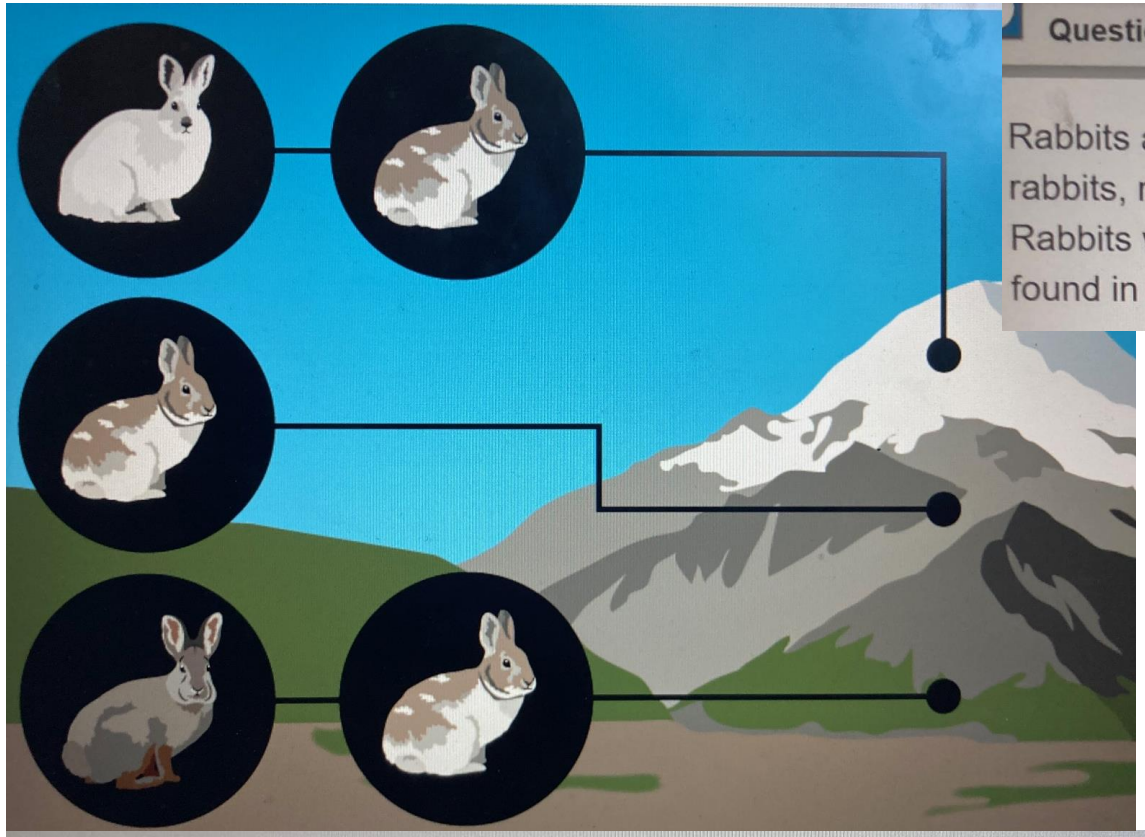
Individual species are in danger of extinction when genetic diversity is low or population sizes are small. **Outline** how population size in a species can decrease.

Due to various man made and non man made reasons, the population sizes of a species can decrease. This can be caused by disease, competition, lack of resources, habitat loss, climate change, pollution, invasive species and overhunting.

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.

Being endothermic animals, they were warm blooded. This helped the mammals stay warm. Another factor was the presence of fur. This would cover the body and protect it from cold, harsh weather.



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

The natural theory of selection states that animals with the features that are best suited to survive to the environment, will survive. Since they have these favourable genes, they can pass them down to their descendants, and thanks to gene inheritance, these descendants will also have these favourable genes. For example if there are black and white rabbits on a mountain, the white rabbits will camouflage from their predators much more easily. The black rabbits will be preyed upon much more often resulting in their decline, while the white rabbits that survive will pass on their genes to their children. Eventually the black rabbits fade out and leave behind the white rabbits.

Question 4a (1 mark)

Select the correct category for each of the following factors.

Draggable items:


Fungi


Soil


Microbes


Water

Biotic	Abiotic
Fungi	Water
Microbes	Soil

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 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

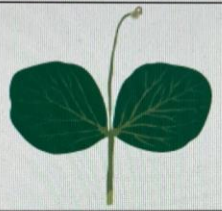
carbon dioxide + Water → oxygen + Glucose

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.

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 

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.

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

B I U x_2 x^2 Ω Σ Styles

Amount of nitrogen in the fertilizer.

Question 4d (1 mark)

State one dependent variable recorded by the students.

B I U x_2 x^2 Ω Σ Styles

Height of Plants in millimetres

Question 4e (2 marks)

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

Quantitative data

Styles

It is numerical data that is completely factual because it is taken based off of measurements. It is almost always a value for a certain attribute of the object.

Qualitative data

Styles

Qualitative data talks about the qualities or rather the features and/or opinion based ideas you have. For example saying the leaf is green is qualitative data for the leaf.

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.

(310+347+332)/3 = 329.7 mm
(196+228+222)/3 = 215.3

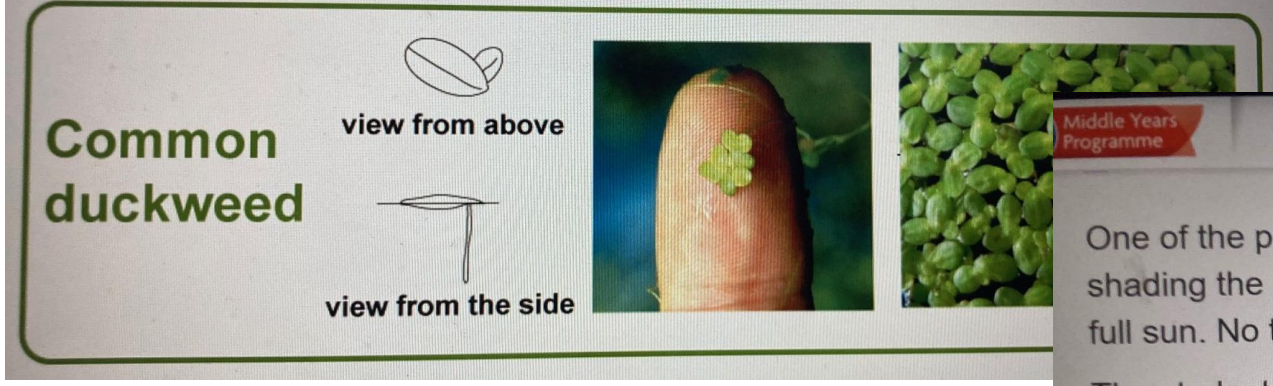
Question 4g (2 marks)

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

Doesn't account for other factors like soil and water. Those plants look way too dried out for something that just hasn't had fertilizer. There were 3 tests across the range. Maybe improve by trying out different amounts of fertilizer to see how effective it is, and how much is the maximum you can use.

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.



The independent variable is the amount of light, this will be manipulated by changing the voltage of the bulbs in order to adjust the brightness.

The dependent variable is the number of duckweed grown. This will be measured by counting the number of duckweed that are present in the pond.

The two control variables are the number of duckweed plants and the amount of water that the plants are given/grown in. They will have to keep the duckweed plants equal in both containers and also ensure that the amount of water that they are grown in is the same amount.

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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.

Materials and Apparatus:
- Duckweed seeds
- water
- bulb
- lux meter
- large beaker

Fill 5 large beakers with equal amounts of water.

Add an equal number of duckweed seeds to each beaker.

Add a bulb to 4 of the beakers and vary the light levels. Leave the bulbs on for 12 hours and off for the other 12 hours in order to mimic natural conditions.

After one month, count the amount of duckweed and note down your results in an observation table. Note down any other observations you have made in your science journal.

I predict that as the amount of light increases, the amount of duckweed that will grow will also increase, this is until a certain extent after which it will be too bright and the plants will either cease growing and start dying off, grow very slowly or just stay constant. This is because in order to live plants go through a process known as photosynthesis. In order to undergo this process, the plant needs sunlight. The more sunlight the plant can take in the more it'll be able to grow. Hence, I believe that as the amount of light increases the amount duckweed that grows will also increase.

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. select equally healthy duckweed plants
3. Label beakers
4. Measure water from pond into each 500 cm^3 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. place lamp facing water bath
9. Place three beakers with samples into each water bath
10. Wait two weeks
11. count final number of duckweed plants and record values

1
2
3

Question 6b (2 marks)

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

B I | U x_2 x^2 | Ω Σ | Styles

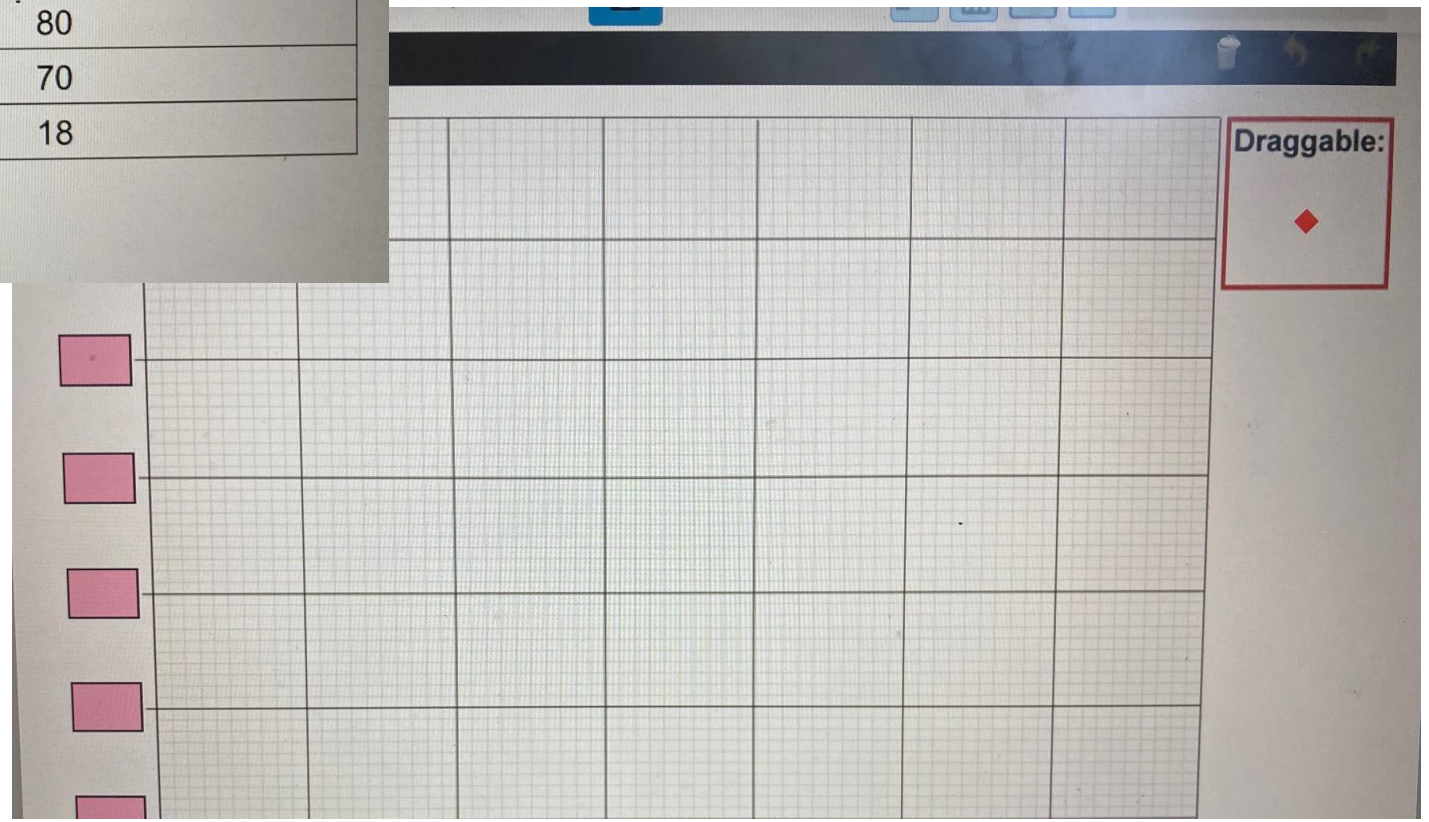
The temperature of the water bath will go down and hence it is important for the water to be regularly reheated and changed, or hot water must be poured in so that it is constantly at the required temperature. Maybe using an electric heater that keeps the temperature constant.

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.



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 U x_2 x^2 Ω Σ Styles

Question 7b (2 marks)

State two control variables for this investigation.

Control variable 1

Styles

Control variable 2

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.

B I U x_2 x^2 Ω Σ Styles

Question 7d (1 mark)

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

B I U x_2 x^2 Ω Σ Styles

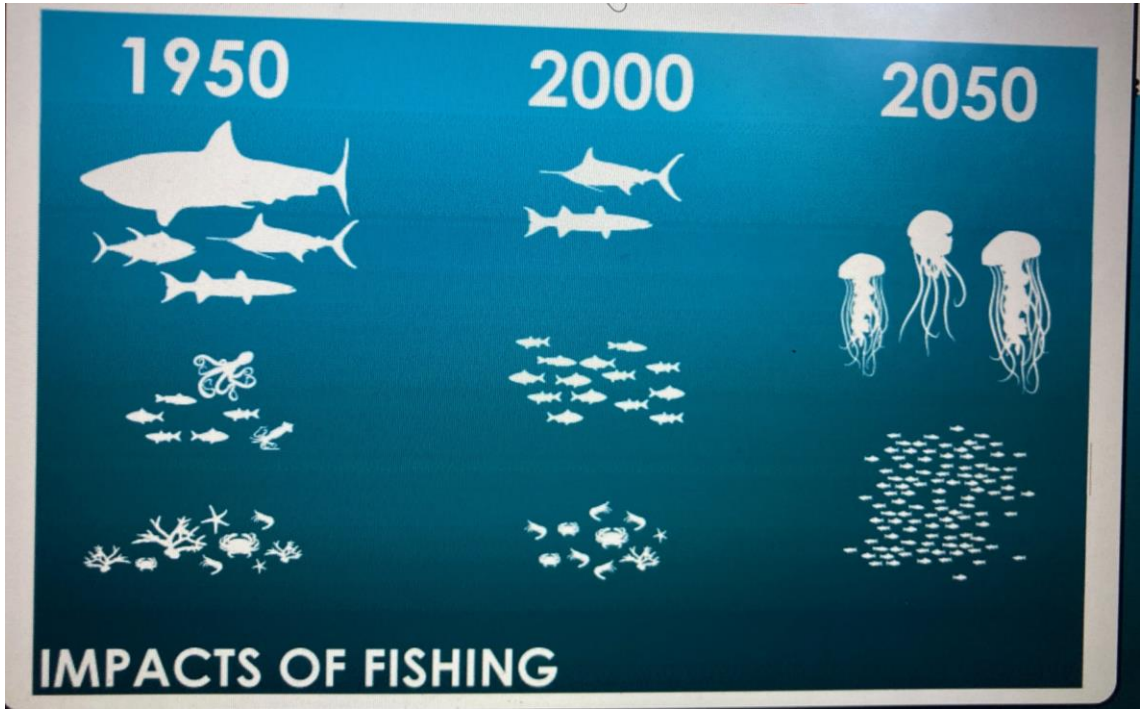
Question 8 (8 marks)

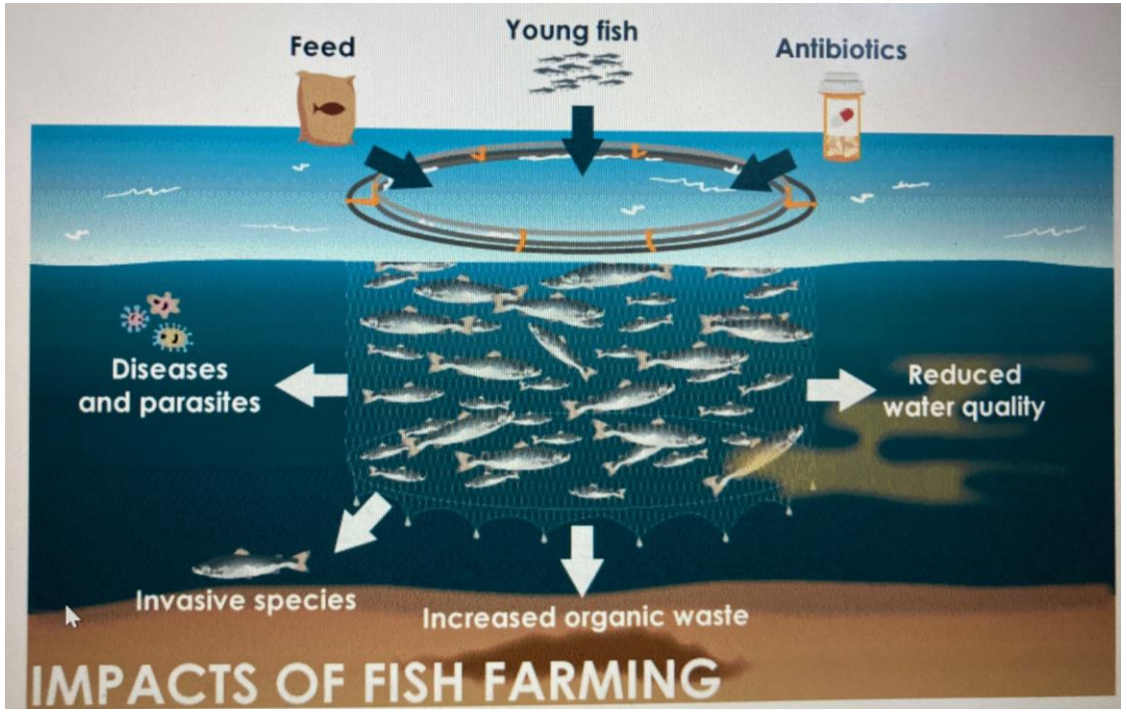
Fish are an important part of many diets around the world. As the human population is increasing, the amount of fish eaten per person is also increasing. This increase in demand for fish has led to unsustainable fishing practices. Decreasing fish populations are a world-wide problem threatening food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

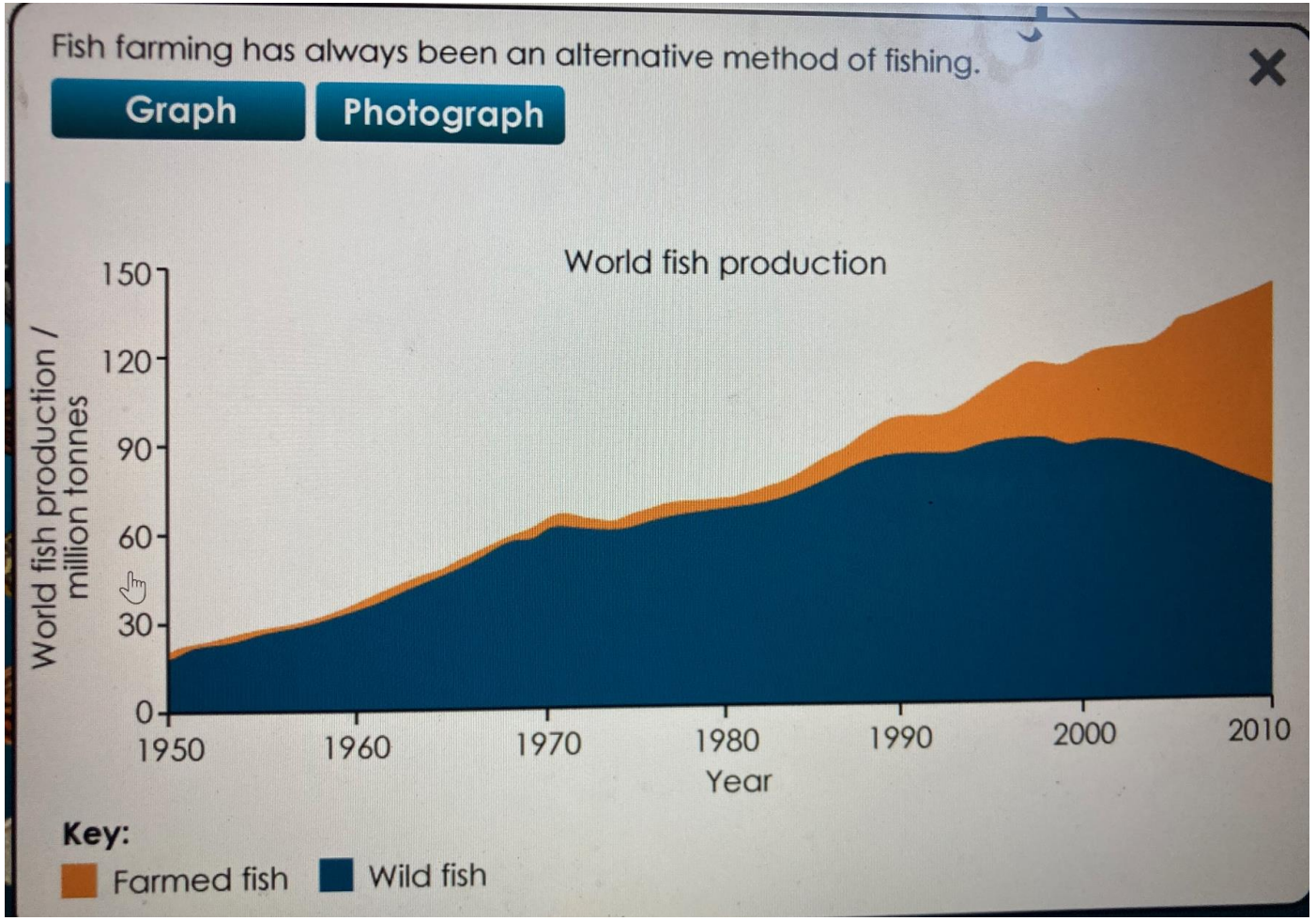
The interactive graphic below gives some information to support this task.

This media is interactive

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


1950
2000
2050
IMPACTS OF FISHING


Feed
Young fish
Antibiotics
Diseases and parasites
Reduced water quality
Invasive species
Increased organic waste
IMPACTS OF FISH FARMING


Fish farming has always been an alternative method of fishing.
Graph
Photograph
World fish production
World fish production / million tonnes
150
120
90
60
30
0
1950
1960
1970
1980
1990
2000
2010
Year
Key:
Farmed fish
Wild fish

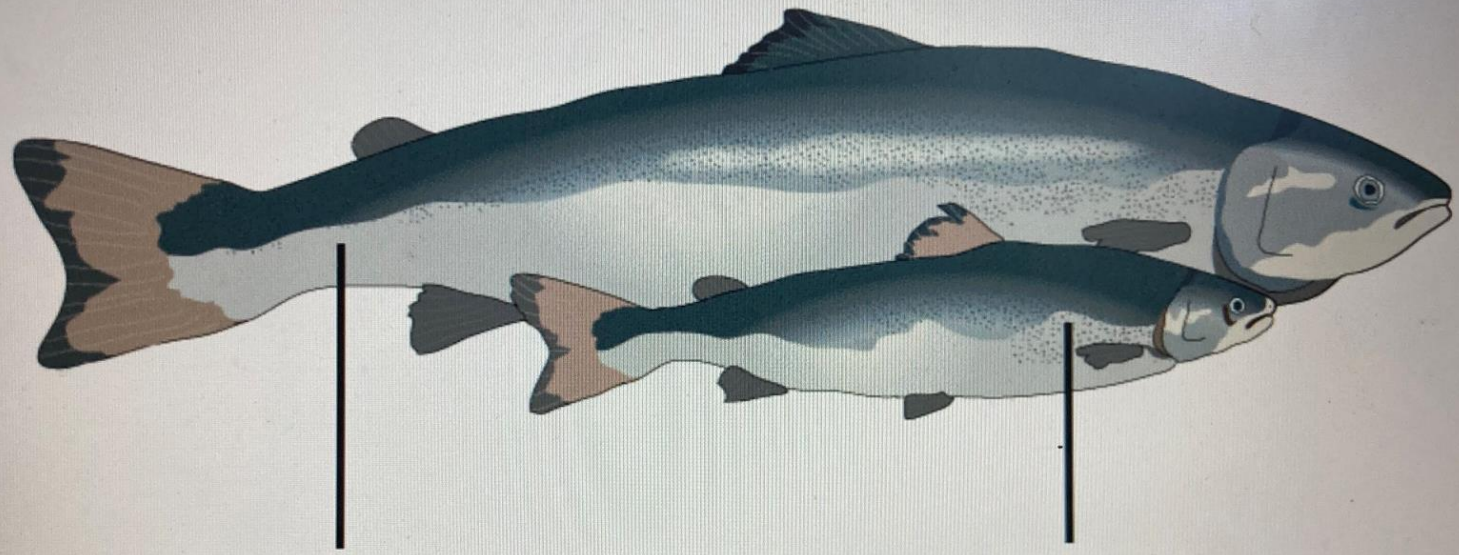
Fishing looks different in different parts of the world. One way the increasing demand for food is being met is by using technology to catch more fish.





Hover over the photos above to see a larger version.

Genetic modification allows farmers to grow bigger fish.



Genetically modified farmed salmon

Length = 60 cm
Mass = 3.0 kg

Farmed salmon

Length = 33 cm
Mass = 1.3 kg

*Both fish are 18 months of age

Question 8a (1 mark)

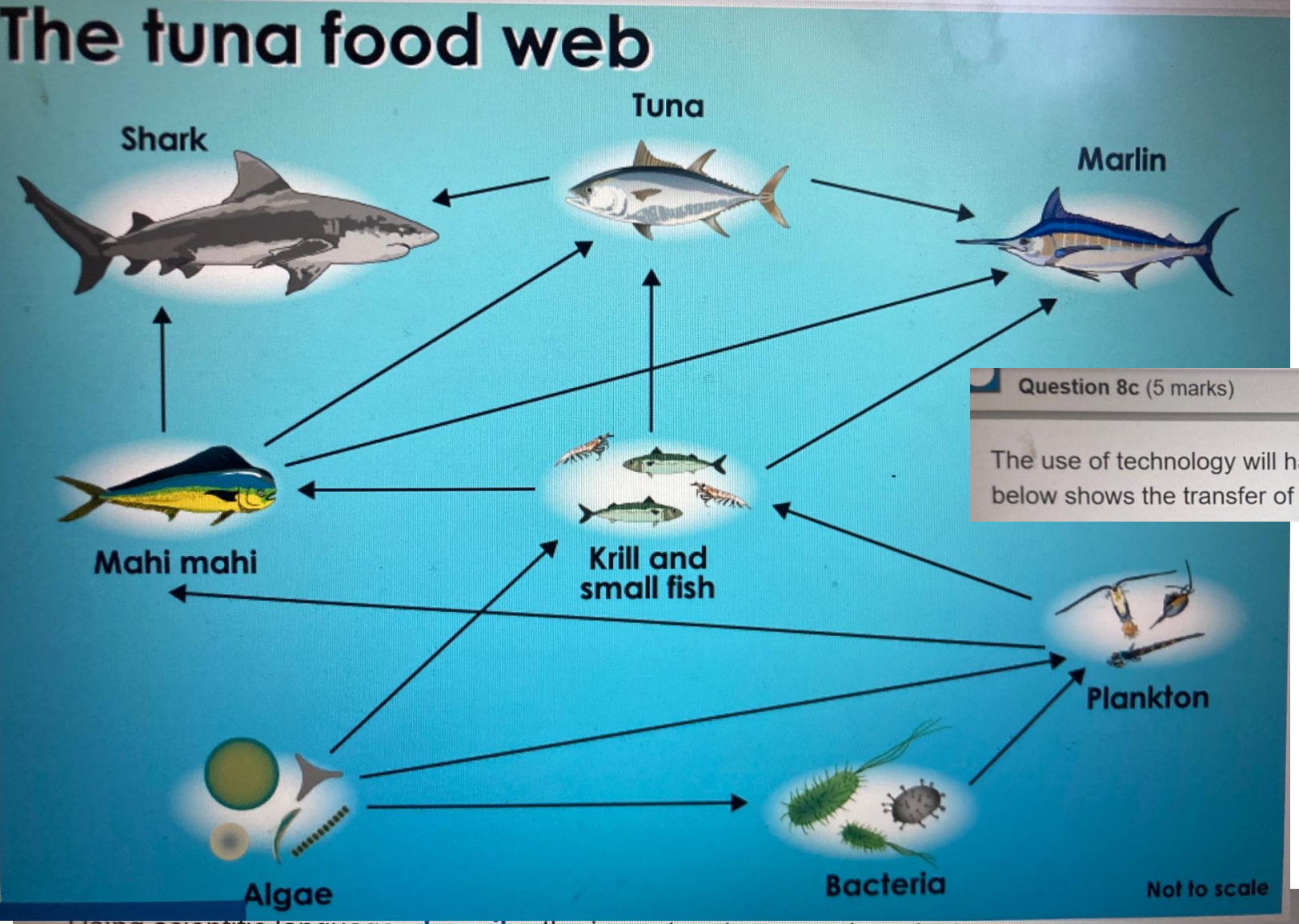
Use the interactive graphic to **state** one reason for a decrease in the total number of wild fish since 1950.

B I U x_2 x^2 Ω Σ Styles

Question 8b (2 marks)

Suggest how technology has allowed more fish to be caught.

B I U x_2 x^2 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_2 x^2 Ω Σ Styles

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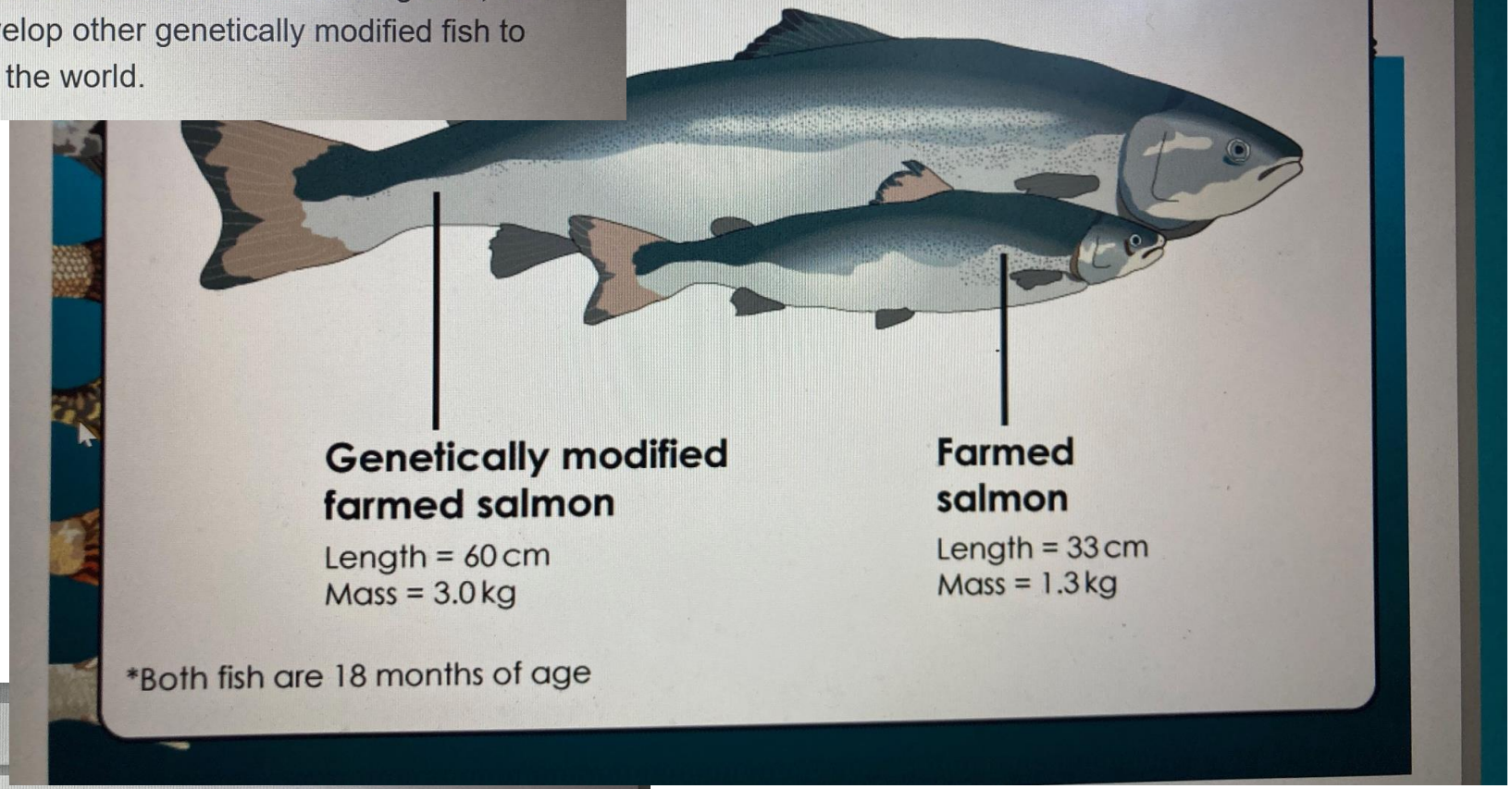
Scientists are currently working to develop genetically modified fish in order to meet the world demand for fish. A genetically modified salmon that can grow faster than a traditional salmon has been developed and is currently being raised in fish farms. The faster a fish grows, the sooner it can be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

mers to grow bigger fish.



Question 9a (2 marks)

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

B I | U x_2 x^2 | Ω Σ | 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.

Scroll down to continue