



Question 1 (14 marks)

All living things are made of cells. All cells come from other cells. The cell is the basic unit of structure and function in all living things.



Question 1a (6 marks)

Describe three functions cells perform to maintain life.

B *I* ← → U x_2 x^2 $\frac{1}{2}$ $\frac{3}{4}$ Ω Σ Styles



Question 1b (6 marks)

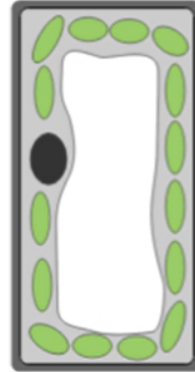
Look at the three images in the tabs below.

State whether each of the three cells shown is a plant cell or an animal cell. **Justify** your answers by identifying key structures.

Image 1

Image 2

Image 3



Cell 1 plant or animal cell

Image 1

Image 2

Image 3

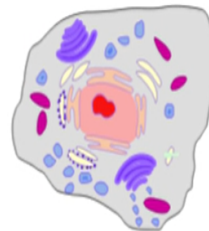


Cell 2 plant or animal cell

Image 1

Image 2

Image 3



Cell 3 plant or animal cell



Question 1c (2 marks)

Some single-celled organisms are not easy to identify as either plant or animal.

Formulate and **explain** a testable hypothesis which could be used to determine if a single-celled organism you are observing is a plant.

B I ← → U ×₂ x² ∫ ∑ Ω Σ Styles -



Question 2 (7 marks)



Question 2a (2 marks)

Look at the images below.

Drag and drop to **organize** the images into a sequence in order of increasing complexity.

Image A



Image B



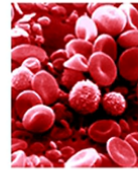
Image C



Image D



Image E



least complex most complex



Question 2b (5 marks)

Describe the movement of an oxygen molecule from the lungs to a muscle cell. Use scientific language and include five points in your answer.

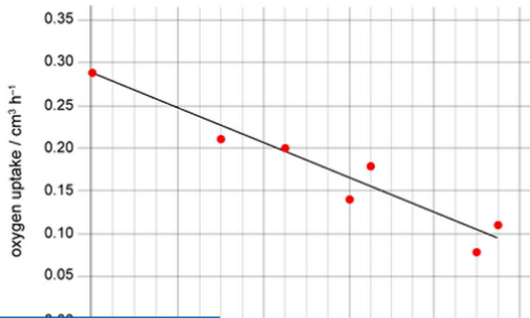
B I | ← → | x₂ x² | ≡ ≡ | Ω Σ | Styles | 🗑️



Question 3 (12 marks)

A fishing community relies on its catch of a type of fish called *Borch* for its staple diet. The fish are starting to show signs of a gill disease which increases the thickness of the gas exchange surface. The increase in thickness affects the fish's oxygen uptake.

The graph shows the consequence of gill disease on average oxygen uptake.



Question 3a (1 mark)

Using the graph, **state** the volume of oxygen taken up per hour by healthy fish without gill disease.

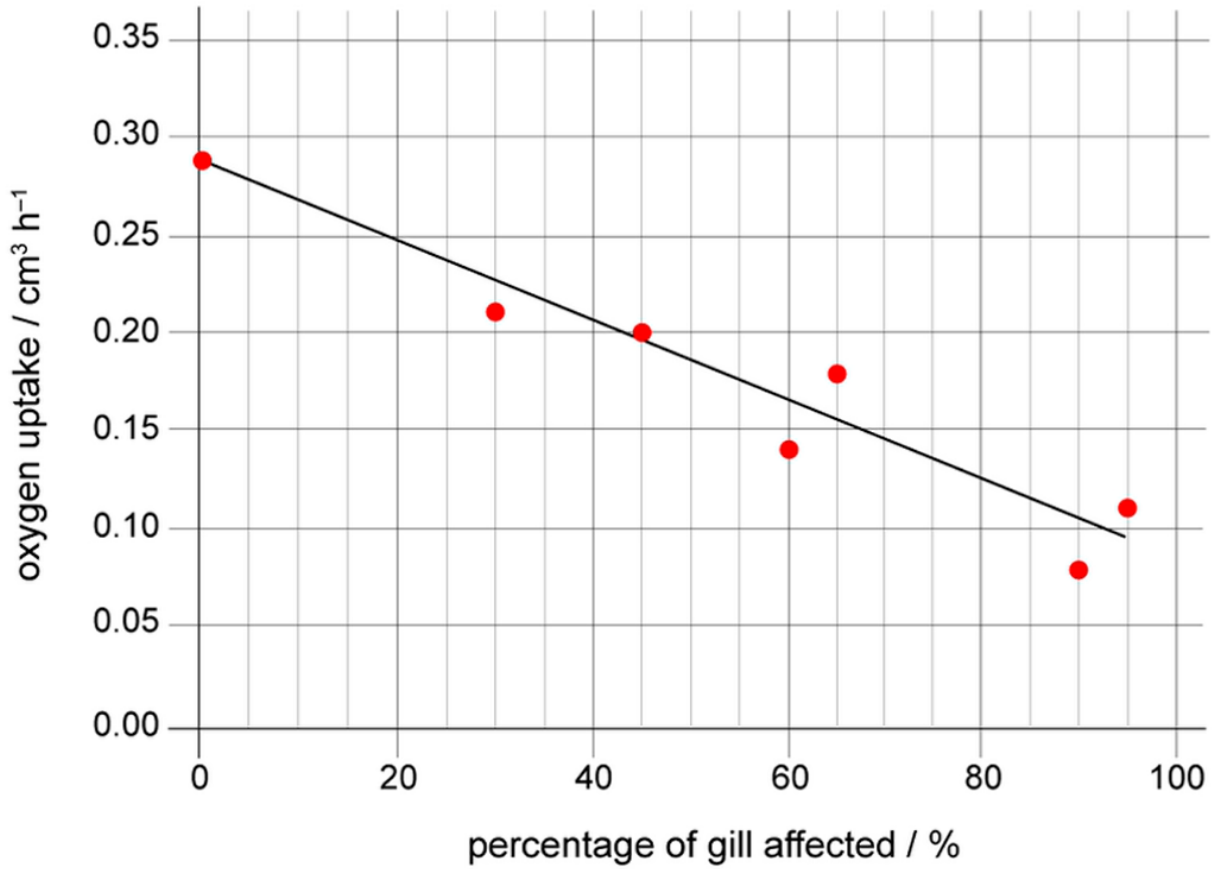
B I | ← → | x₂ x² | ≡ ≡ | Ω Σ | Styles | 🗑️



Question 3b (1 mark)

Using the graph, **outline** the relationship

The graph shows the consequence of gill disease on average oxygen uptake.



Question 3b (1 mark)

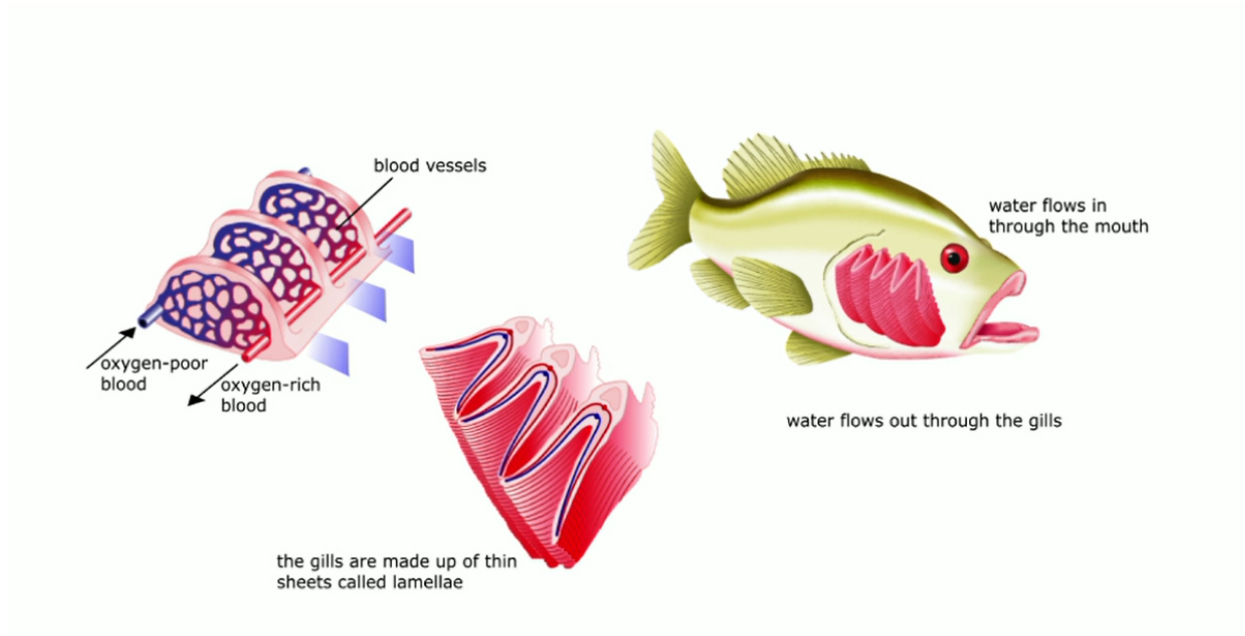
Using the graph, **outline** the relationship between the amount of gill affected and the oxygen uptake of the fish.

B *I* | ← → | U x_2 x^2 | $\frac{1}{2}$ $\frac{3}{4}$ | Ω Σ

Styles ▾ |

In a fish, the gills form the oxygen uptake system.

Note: This video contains no audio



Question 3c (3 marks)

Compare and contrast the structure and function of the fish's gill to a human lung.

B *I* | ← → | \times_2 \times^2 | $\frac{1}{x}$ $\frac{1}{x^2}$ | Ω Σ | Styles |



Question 3d (2 marks)

Using the information provided, **suggest** why increased thickness of gills would impact oxygen uptake.

B I | ← → | x₂ x² | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕



Question 3e (5 marks)

If the gill disease spreads through the fish population, **discuss** the potential consequences for the biological community. In your answer you need to consider:

- how the food chain will be affected
- the size of the fish population
- the effects of reduced oxygen on the activities of the diseased fish
- the effects on the human community that harvests the fish.

B I | ← → | x₂ x² | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕



Question 4 (9 marks)

One indicator of fitness is a measurement of how efficiently the body can consume oxygen. An athlete can consume more oxygen per minute while exercising at maximum intensity than a less fit person. There are a number of different ways that maximum oxygen consumption can be measured. Many of the methods used to measure maximum oxygen consumption involve an athlete exercising for a fixed time on a running track or a treadmill. The results of tests such as these can be used to monitor the effect of training on an athlete's physical performance.

In order to gather data such as this, the experiment must be designed to take account of variables.



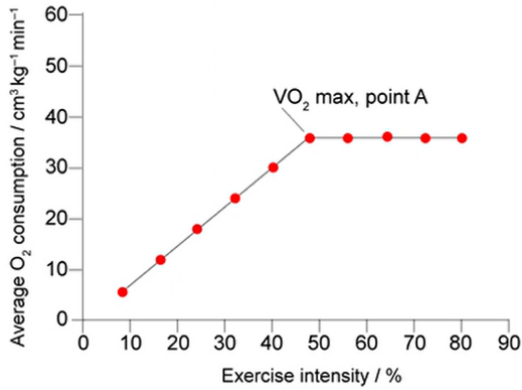
Question 4a (2 marks)

List two variables that should be controlled during an experiment to measure maximum oxygen consumption.

Variable 1

Question 4b (2 marks)

The graph shows the results of an experiment measuring oxygen (O_2) consumption during exercise of varying intensity.



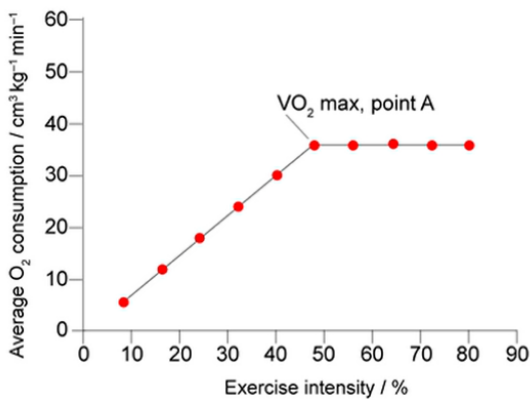
State the type of relationship shown in the graph of oxygen consumption and exercise intensity.

Rich text editor interface with a toolbar containing Bold (B), Italic (I), Underline (U), subscript (x_2), superscript (x^2), bulleted list, numbered list, link (Ω), and insert (Σ) icons. Below the toolbar is a text input area.



Question 4c (5 marks)

The graph shows the results of an experiment measuring oxygen (O_2) consumption during exercise of varying intensity.



Describe the pattern between oxygen consumption and exercise intensity and explain what is happening on a cellular level just before and just after point A.

Rich text editor interface with a toolbar containing Bold (B), Italic (I), Underline (U), subscript (x_2), superscript (x^2), bulleted list, numbered list, link (Ω), and insert (Σ) icons. Below the toolbar is a text input area.





Question 5 (20 marks)



The scientific advisor of a country with poor soil has to decide whether to invest in research to develop more effective fertilizers. Alternatively she could recommend to invest in researching genetically modified crops that are more efficient in absorbing nutrients from poor soils and can be grown without fertilizers.

In this question you are analysing the method used by a team of scientists investigating genetically modified (GM) maize. The scientists studied growth of **GM** maize grown **without** fertilizer compared to **traditional (non GM)** maize grown **with** fertilizer. The groups of plants used in the experiment are shown.

One independent variable in this study is the type of maize used, GM or traditional (non GM).



Question 5a (1 mark)

State one other independent variable being investigated in this study.



Question 5b (1 mark)

Select an appropriate hypothesis that could have been tested in **this** experiment.

- A.** Soils that are rich in nutrients produce better growth in maize crops than soils that are nutrient-poor.
- B.** GM maize can produce more growth from nutrient-poor soil than traditional maize.
- C.** GM maize can produce the same growth in nutrient-poor soils as traditional maize in nutrient-rich soils.
- D.** GM maize produces better growth than traditional maize.



Question 5c (4 marks)

Label the table for the scientists to collect the height of the plants.

Using the tool, **select** and **measure** suitable plants and collect data.

Record your data to an appropriate number of **significant figures**.

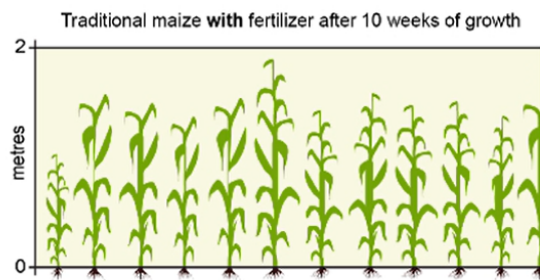
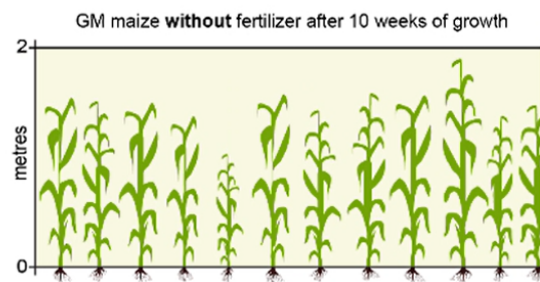
Table Size
Step 2

Table Data
Step 3

1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Reset

Please enter your data into the table (including any





Question 5d (2 marks)

Calculate the mean (average) of your data for each group.

B *I* ← → U \times_2 \times^2 $\frac{1}{x}$ $\frac{1}{x^2}$ Ω Σ Styles



Question 5e (3 marks)

Select a graph to present this data. Label the axes of your graph and give it a suitable title.

Pie chart ▾

	A	B	C
1	1		
2	2		
3	3		
4	4		
5	5		
6	6		
7	7		
8	8		
9	9		
10	10		

Chart title

Enter chart title here

Labels

Select labels

Please select labels

Values

Select values

Please select values



Question 5f (3 marks)

Analyse the results of this experiment using scientific reasoning.

Results



Question 5g (5 marks)

Discuss and **evaluate** the method used to investigate the growth of GM maize. In your answer consider:

- one feature of the method that ensures that it is valid
- one feature that could be changed to improve the validity of the method
- how the investigation could be extended
- how your suggested extensions to the method could improve the validity of conclusions of the investigation.

B *I* | ← → | U x_2 x^2 | \equiv \equiv | Ω Σ | Styles ▾ |



Question 5h (1 mark)

In this experiment height was chosen as a measure of growth.

Other than height, **suggest** another way the scientists could have chosen to measure growth of the maize plants.

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Question 6 (30 marks)

Bt cotton is a genetically modified (GM) cotton plant that has been developed to produce its own pesticide which kills or deters insects from eating the plant. However, this is not a selective pesticide and the plant itself is toxic to other organisms.

Question 6a (17 marks)

Design one experiment that could be conducted to study the possible effects of growing Bt cotton on an ecosystem. You should include:

- a testable hypothesis
- identification of the variables
- a description of the method
- a description of how to manipulate the variables.

B *I* ← → U x_n x^2 $\frac{1}{2}$ $\frac{3}{4}$ Ω Σ Styles

Question 6b (13 marks)

Consider the wider use of genetically modified organisms (GMOs) either using examples from your MYP studies or from earlier questions. **Discuss** and **evaluate two** different implications of how the use of GMOs could impact an ecosystem. In this extended piece of writing you should support your answer with scientific evidence and explanations considering:

- what is meant by the term ecosystem
- the advantages and disadvantages of GMOs
- the consequences of introducing GMOs to an ecosystem
- the responsibilities we should consider before introducing GMOs from both an ethical and an economic perspective.

B *I* ← → U x_n x^2 $\frac{1}{2}$ $\frac{3}{4}$ Ω Σ Styles

Question 7 (7 marks)

Advances in human capability mean that vaccines are now available to treat diseases that once killed millions of people every year. The Global Vaccine Action Plan is a framework designed to increase equal access to vaccines for people in all communities. Vaccines need to be produced, stored and transported in sterilized and refrigerated conditions. Vaccines also need to be administered by experienced healthcare workers. In isolated communities poor transport links create additional difficulties. Although the World Health Organization promotes the use of vaccines to protect against infectious diseases, some communities are against their use for a range of reasons.

Question 7a (2 marks)

State the meaning of the term *vaccine*.

B *I* | ← → | x₂ x² | \int \sum | Ω Σ | Styles |

Question 7b (5 marks)

Describe how vaccines protect organisms against infectious diseases caused by pathogens.

B *I* | ← → | x₂ x² | \int \sum | Ω Σ | Styles |



Question 8 (21 marks)

Scientists have been testing several crops to use them as edible vaccines against tropical, water-related diseases such as hepatitis, cholera, malaria and polio. The banana is a suitable fruit for this purpose. Bananas are grown in tropical countries and are covered by a thick skin that keeps them sterile.



Question 8a (6 marks)

A scientist would like to test if edible vaccines are as effective as traditional vaccines.

Identify the dependent, independent and control variables in this study.

For each one, **justify** your choice.

Dependent variable



Question 8b (15 marks)

Discuss and **evaluate** how using GM bananas as edible vaccines in tropical developing countries improves access to protection against diseases. In this extended piece of writing consider:

- advantages and disadvantages of using GM bananas compared to traditional vaccines
- effect on an individual of an improved immune system
- wider effects on a community as a result of an improved immune system
- wider effects on the ecosystem
- ethical issues related to vaccination.

B *I* ← → U ×₂ x² ☰ ☱ Ω Σ Styles ▾ 🗑️