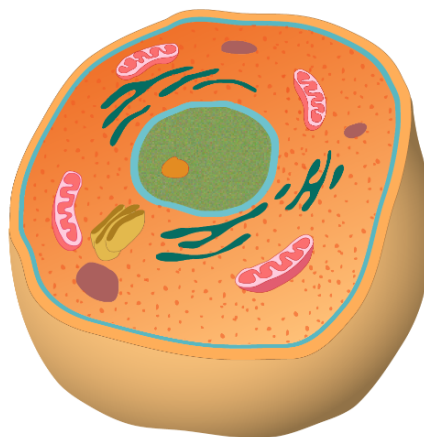


Question 1 (10 marks)

Question 1a (2 marks)

For a system to be successful, every part of it must perform its specific function.



Select the organelle responsible for each function.

Select the organelle responsible for each function.

Function	Organelle
Stores genetic material	<input type="text" value=""/>
Controls what goes in and out of the cell	<input type="text" value=""/>
Makes proteins	<input type="text" value=""/>



Select the organelle responsible for each function.

Function	Organelle
Stores genetic material	<input type="text" value=""/>
Controls what goes in and out of the cell	<input type="text" value=""/>
Makes proteins	<input type="text" value=""/>

- Cell membrane
- Cytoplasm
- Mitochondria
- Nucleus
- Ribosome

Reset





Question 1b (2 marks)

Specialized cells such as red blood cells and white blood cells develop from stem cells found in bone marrow. **State** the function of these two types of cell.



Red blood cell

B I | ← → | x₂ x² | ≡ ≡≡ | Ω Σ

Styles - [icon]

White blood cell

B I | ← → | x₂ x² | ≡ ≡≡ | Ω Σ

Styles - [icon]



Question 1c (3 marks)

There are many types of specialized cells. For example, specialized cells can have different numbers and types of organelles in them.

Sperm cells have a high number of mitochondria to carry out cellular respiration and release the energy needed to move towards an egg. Use the image below to **describe** how structure A is specialized to conserve an organism's **chromosome number** when fertilizing an egg. You must use scientific terminology in your answer.



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



Question 1d (3 marks)

Cells can carry out aerobic and anaerobic cellular respiration. **Discuss** the differences between the two types of cellular respiration in animal cells.

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





Question 2 (11 marks)



Question 2a (2 marks)

During puberty, children's bodies change as they grow into adults. These changes are controlled by hormones.

When they reach puberty, females will start to menstruate, and males will start to produce sperm. **State** one other physical change that occurs only for females and one that occurs only for males.



Female

B *I* | ← → | x₂ x² | ☰ ☷ | Ω Σ

Styles ▾ | 📄 ↕

Male

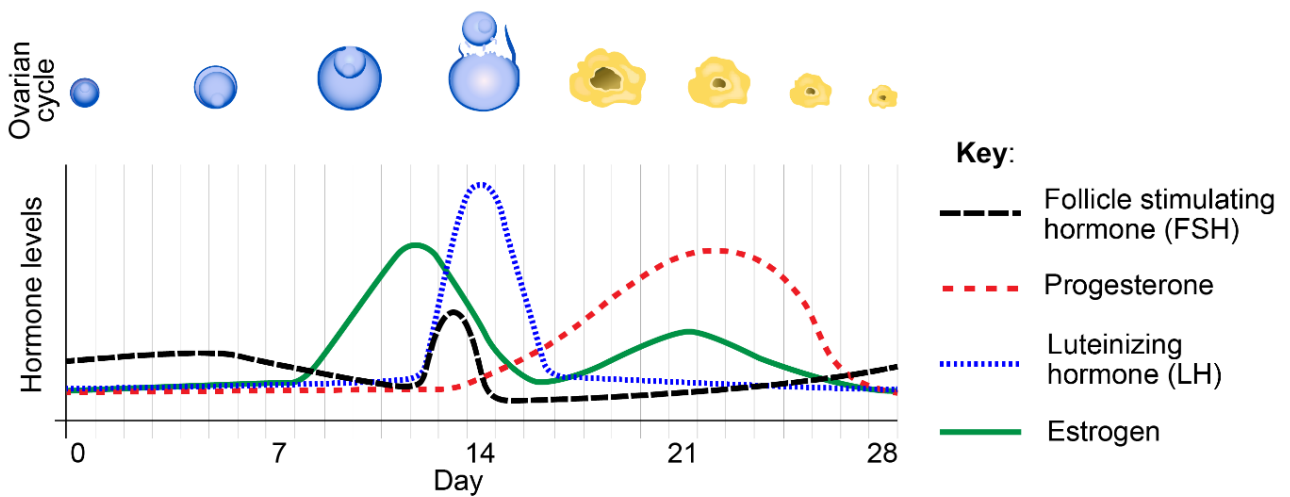
B *I* | ← → | x₂ x² | ☰ ☷ | Ω Σ

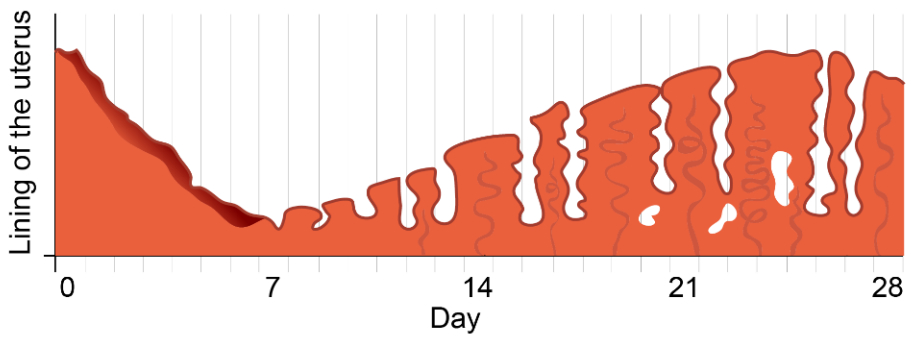
Styles ▾ | 📄 ↕



Question 2b (3 marks)

The menstrual cycle is an example of a process controlled by hormones as shown in the diagram below.





Use the diagram to **describe** how estrogen and progesterone work together to prepare the body for pregnancy.

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



Question 2c (1 mark)

Follicle stimulating hormone (FSH) causes an egg to mature in an ovary. Use the diagram in part (b) to **suggest** the role of luteinizing hormone (LH).

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

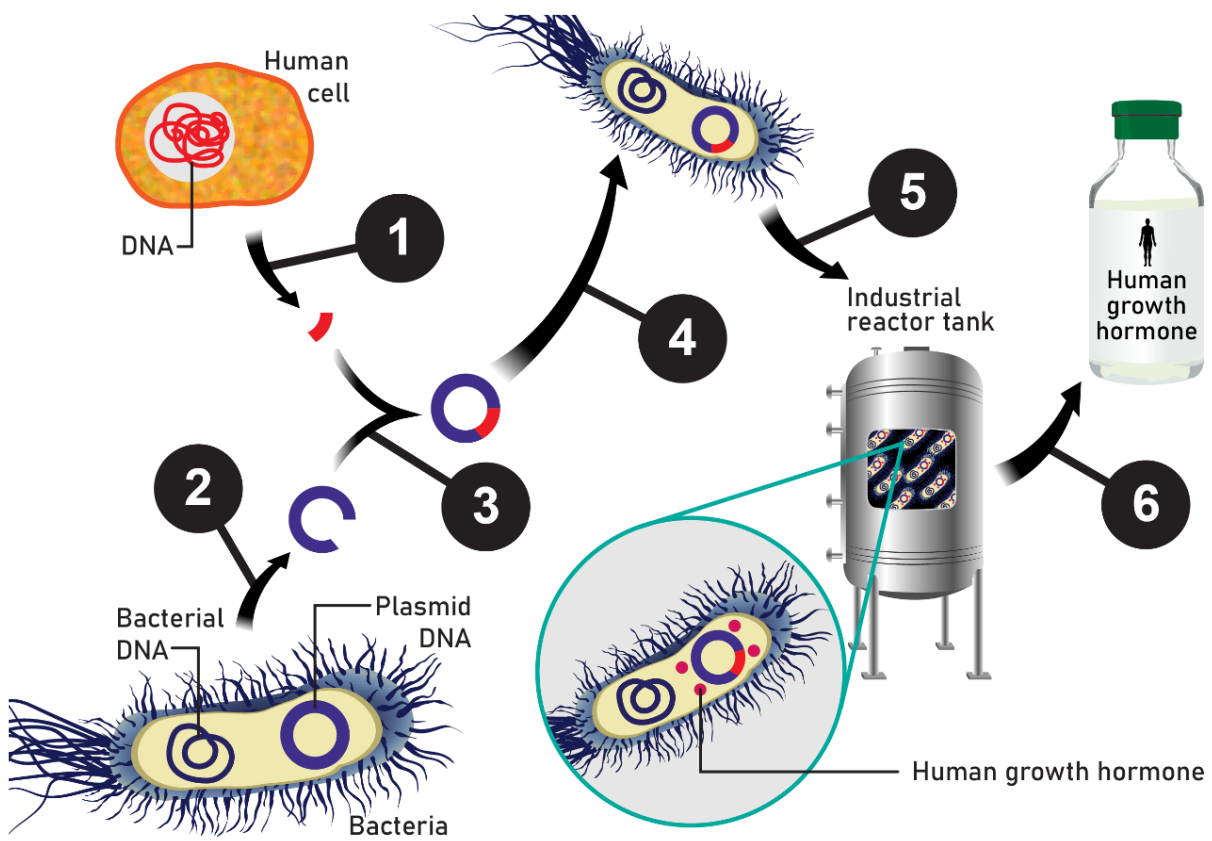




Question 2d (3 marks)

Human growth hormone (HGH) stimulates childhood growth and helps maintain tissues and organs throughout life. Growth disorders can happen when there is not enough HGH being produced. Synthetic HGH can be used to treat growth disorders. Synthetic HGH is made using genetic modification.

Use the diagram to **outline** the missing steps in the process used to make synthetic HGH.



1

2

Plasmid DNA extracted and opened using an enzyme

3

HGH gene and plasmid are combined

4

4

5

6





Question 2e (2 marks)

Suggest why synthetic HGH must be injected rather than taken in tablet form.

B *I* | ↶ ↷ | U x_2 x^2 | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕





Question 3 (7 marks)



Question 3a (1 mark)

Living organisms are classified into groups based on shared characteristics. For example, only mammals have a placenta.

State another characteristic specific to mammals.

B *I* ← → U x_2 x^e \int \sum Ω Σ Styles

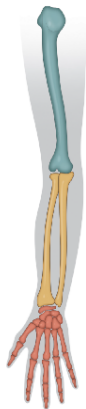




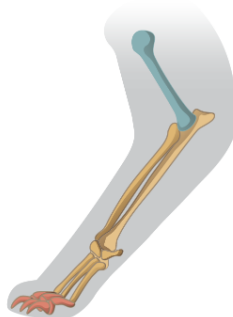
Question 3b (3 marks)

The image below shows the front limb bones of different animals. The colours show different groups of bones. The structure of the front limb has evolved from a common ancestor and is found in different groups of vertebrates.

Human



Cat



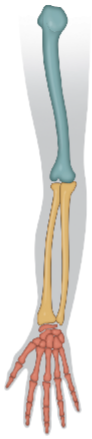
Whale



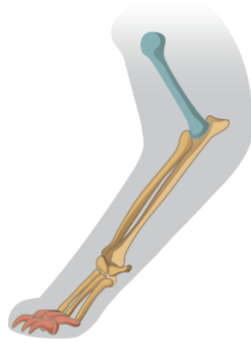
Frog

Bird

Human



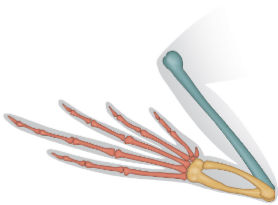
Cat



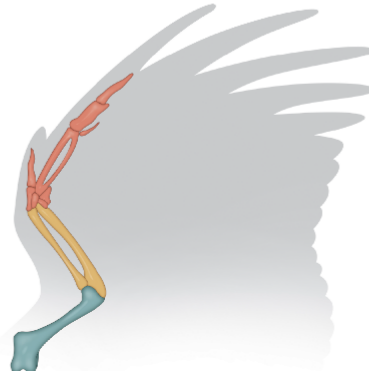
Whale



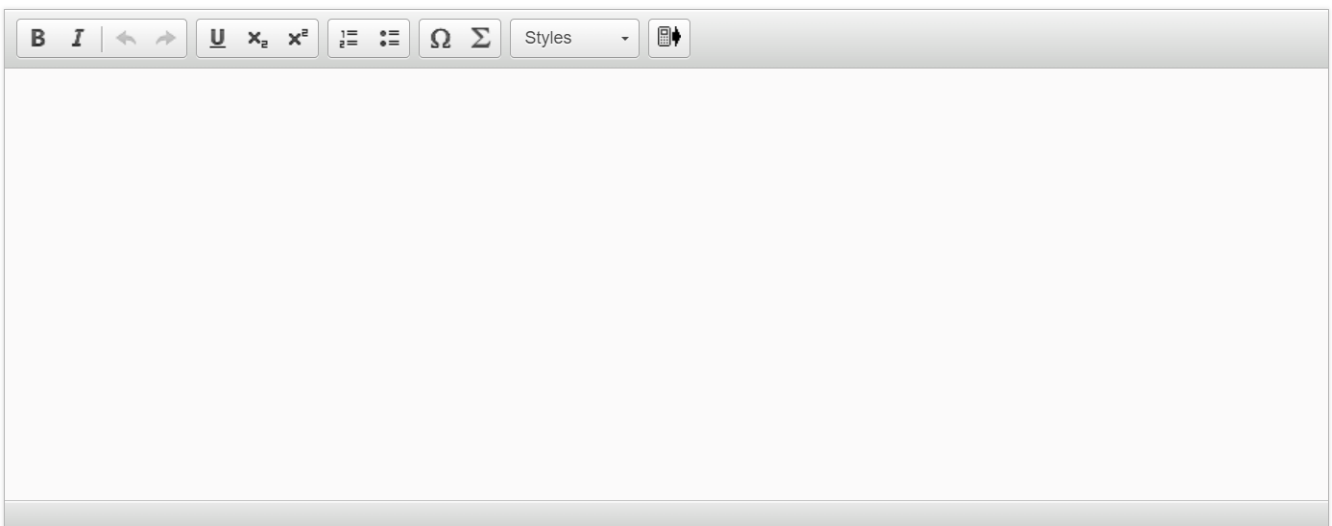
Frog



Bird



Using the image, **discuss** if the structure of the front limb is a good characteristic to identify mammals from other classes of vertebrates.

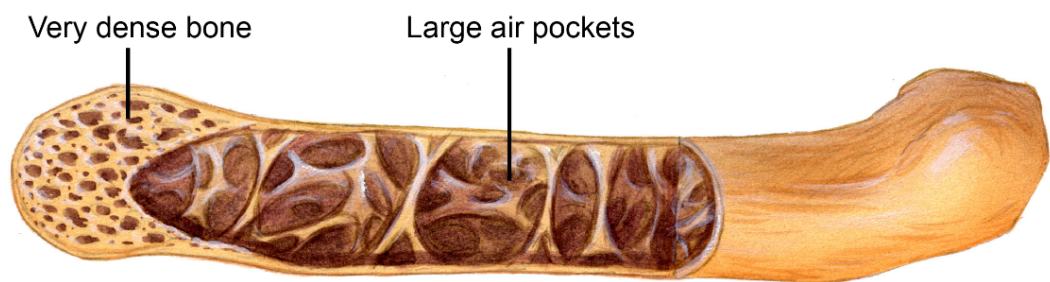


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Question 3c (3 marks)

Although similar in structure, the limbs shown in part (b) are used for different purposes. The structure of the bone itself also differs. Below is an example of the structure of a bone in birds.



©

Use the image to **suggest** how the combination of very dense bone and air pockets is an adaptation that allows birds to fly.

B *I* | ← → | x_2 x^2 | \int \sum | Ω Σ | Styles |



Question 4 (13 marks)







Living organisms have dynamic relationships with their environments. Soil pH is an important factor for plant growth. Soil pH measures the acidity or alkalinity of the soil, with values below 7 representing acidic and above 7 alkaline.

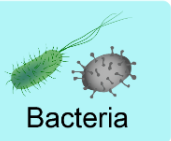



Question 4a (1 mark)

Plant growth is influenced by a variety of biotic and abiotic factors. **Classify** the factors below. The first two have been completed for you.

Draggable items:

 Temperature	 Soil pH	 Light	 Insects
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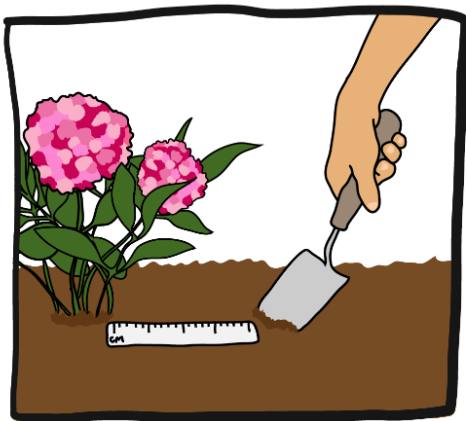
Biotic factors	Abiotic factors
 Bacteria	 Water



Question 4b (2 marks)

Hydrangeas are a group of related flowering plant species. Some hydrangea flowers can change colour depending on the pH of the soil.

A group of students wanted to investigate the relationship between soil pH and flower colour. They sampled soil from under different hydrangea plants in their neighbourhood, using the method shown below:



1. Dig up 75 g of soil from a depth of 5 cm.



2. Remove rocks and twigs, put in Petri dishes and dry in an oven overnight.



Scroll down to continue

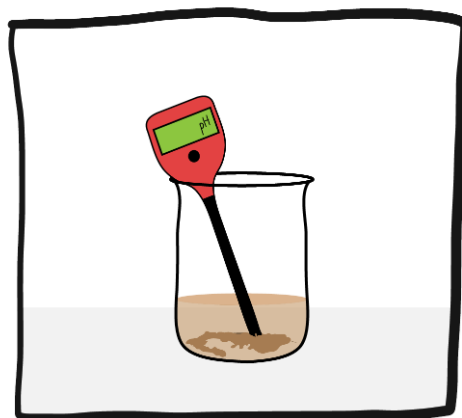


1. Dig up 75 g of soil from a depth of 5 cm.







3. Measure out 50 g of dry soil, mix with 50 cm³ of distilled water and let it rest for 3 hours.





2. Remove rocks and twigs, put in Petri dishes and dry in an oven overnight.



4. Use a pH probe to measure the soil pH.

The data the students collected is shown below.

Flower colour	Soil pH			
	Trial 1	Trial 2	Trial 3	Average
Blue 	5.21	5.54	5.32	
Purple 	6.21	6.32	6.35	6.29
Pink 	7.51	7.92	8.17	7.87
White 	5.46	6.55	7.67	6.56

Flower colour	Soil pH			
	Trial 1	Trial 2	Trial 3	Average
Blue 	5.21	5.54	5.32	
Purple 	6.21	6.32	6.35	6.29
Pink 	7.51	7.92	8.17	7.87
White 	5.46	6.55	7.67	6.56

Calculate the missing average. Show your working in the box below and add your final value to the table, giving your calculated value to an appropriate number of decimal places.

B **I** | ← → | U \times_2 \times^2 | $\frac{1}{2}$ $\frac{3}{2}$ | Ω Σ | Styles ▼ | 📱

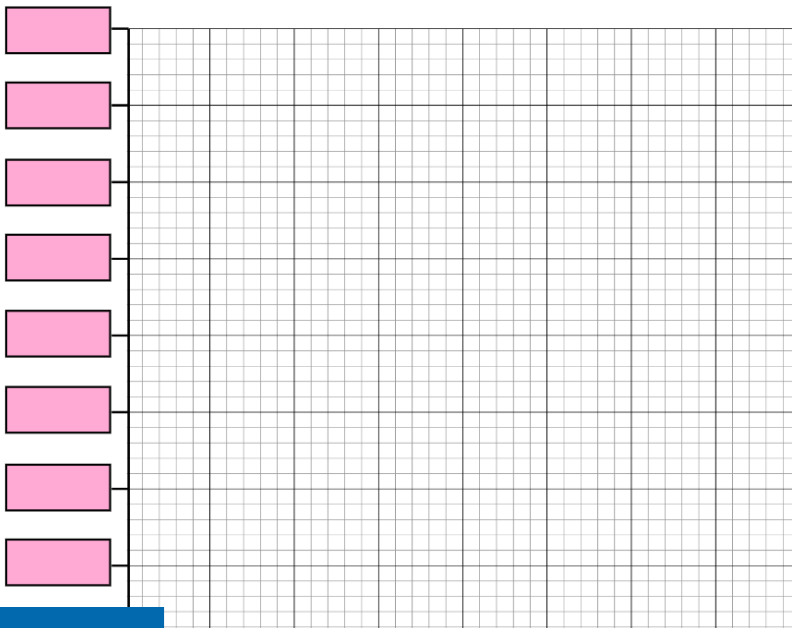
Wiris Editor





Question 4c (5 marks)

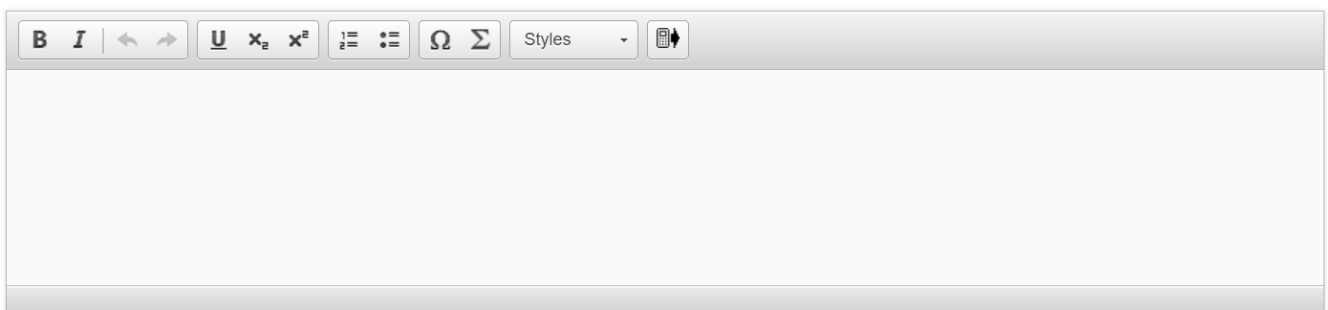
Plot the average data from part (b) in the bar graph below.



Draggable:

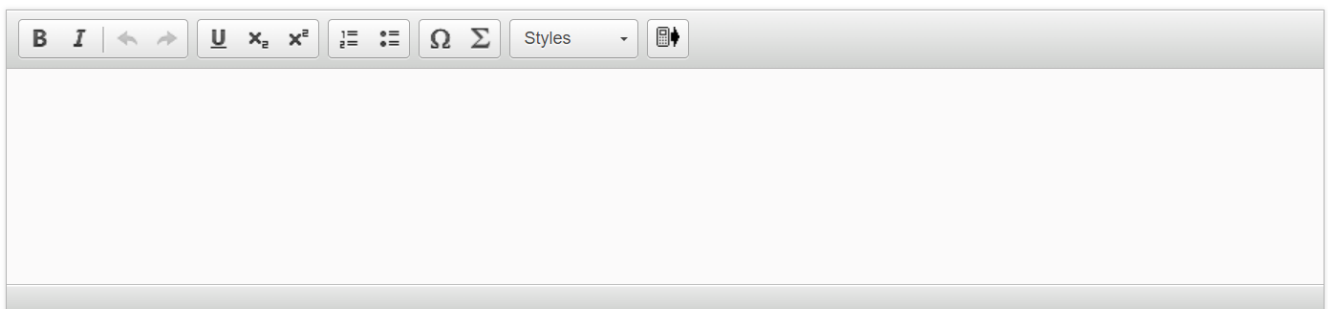


x axis label:



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y axis label:



A rich text editor toolbar with icons for bold, italic, undo, redo, underline, subscript, superscript, bulleted list, numbered list, link, unlink, styles, and mobile view, followed by a large empty text area.



Question 4d (1 mark)

State why a bar graph is the most appropriate type of graph to present the students' data.

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



Question 4e (2 marks)

Suggest an improvement to make the data more reliable. **Justify** your answer.

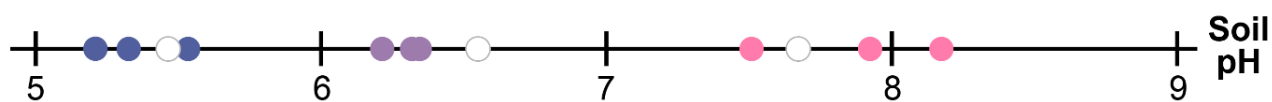
B *I* | ← → | U x_2 x^2 | \equiv \equiv | Ω Σ | Styles ▾ | 📱



Question 4f (2 marks)

To further understand their data, the students presented it in a different visual form. The students hypothesized that one of the hydrangeas was from a different species.

Use the diagram below to **identify** which plant is from a different species. **Justify** your answer.



Blue



Purple



White



Pink

Justification:



Question 5 (16 marks)

The students wanted to learn more about the relationship between soil pH and plant growth. They chose to use *Zoysia* grass as their model plant. The method they followed is below. Their teacher prepared and provided five soil samples with different pH values.

- 1 Put 200 g of soil with a pH of 5 in a small pot labelled pH 5.



2 Repeat for soils with pH of 6, 7, 8 and 9.



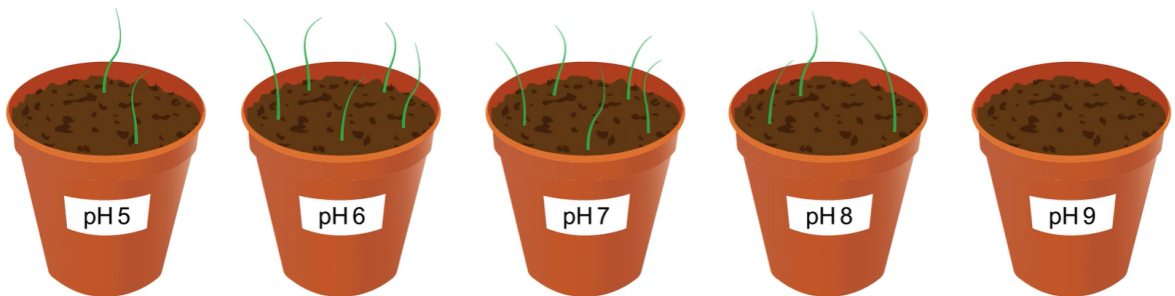
3 Plant five grass seeds in each one.



4 Water each pot with the same volume of water every day for two weeks.



5 After two weeks, count the number of blades of grass in each pot.





Question 5a (2 marks)

The students did not know which chemicals were used to manipulate the soil pH. **State** and **justify** a safety precaution they should take when working with the different soils.

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



Question 5b (4 marks)

Identify the independent variable, the dependent variable and two control variables used in the method above.



Independent variable

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

Styles ▾

Dependent variable

Control variable 1

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

Styles ▾

Control variable 2



Question 5c (2 marks)

Suggest two different control variables that were **not** included in the method above.



Control variable 1

B I | ← → | x₂ x² | ☰ ☷ | Ω Σ

Styles ▾ | 📄 ↕

Control variable 2

B I | ← → | x₂ x² | ☰ ☷ | Ω Σ

Styles ▾ | 📄 ↕

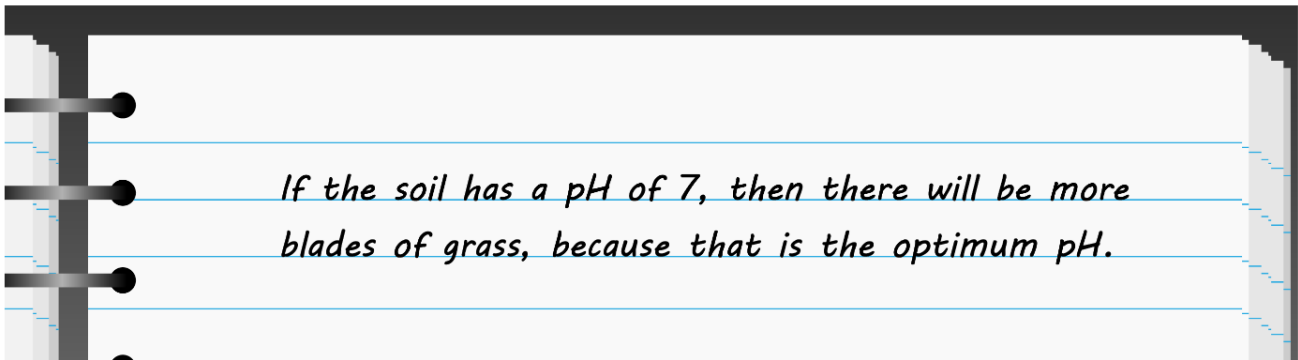


Question 5d (3 marks)

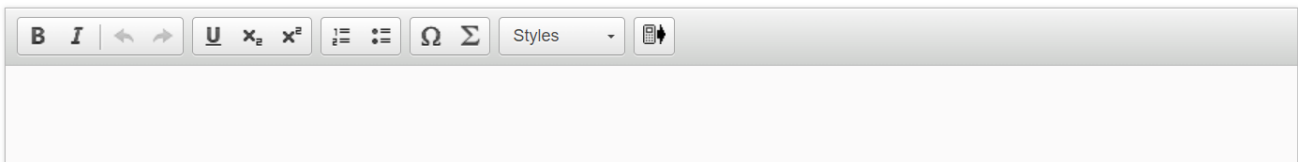
After two weeks, the students recorded their results in the table below.

Soil pH	Number of blades of grass
5	2
6	5
7	5
8	3
9	0

The students made the following hypothesis:



Use the results in the table to **discuss** the validity of their hypothesis.





Question 5e (2 marks)

The students decided to measure the length of each blade of grass. Their data is shown below.

Soil pH	Length / cm				
	Blade 1	Blade 2	Blade 3	Blade 4	Blade 5
5	6 mm	8 mm	—	—	—
6	3.0	3.2	3.5	4.0	3.8
7	4.0	4.9	4.1	4.6	4.8
8	1	1	1 cm	—	—
9	—	—	—	—	—

Key:

— no seeds germinated

Using the data in part (d) and the data above, **identify** the optimum soil pH for growing *Zoysia* grass. **Justify** your answer.



Question 5f (1 mark)

One student suggested that 6.5 might be the optimum soil pH for *Zoysia* grass growth. **Suggest** how the student could verify this.

B *I* | ← → | x_n x^2 | ☰ ☷ | Ω Σ | Styles ▾ | 📄





Question 5g (2 marks)

Suggest two improvements to the **presentation** of the students' data in part (e).

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

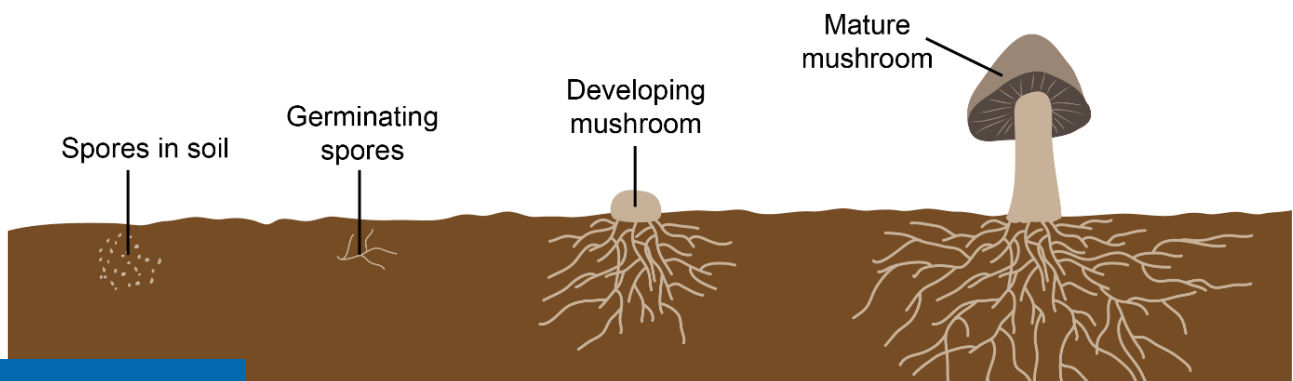


Question 6 (17 marks)

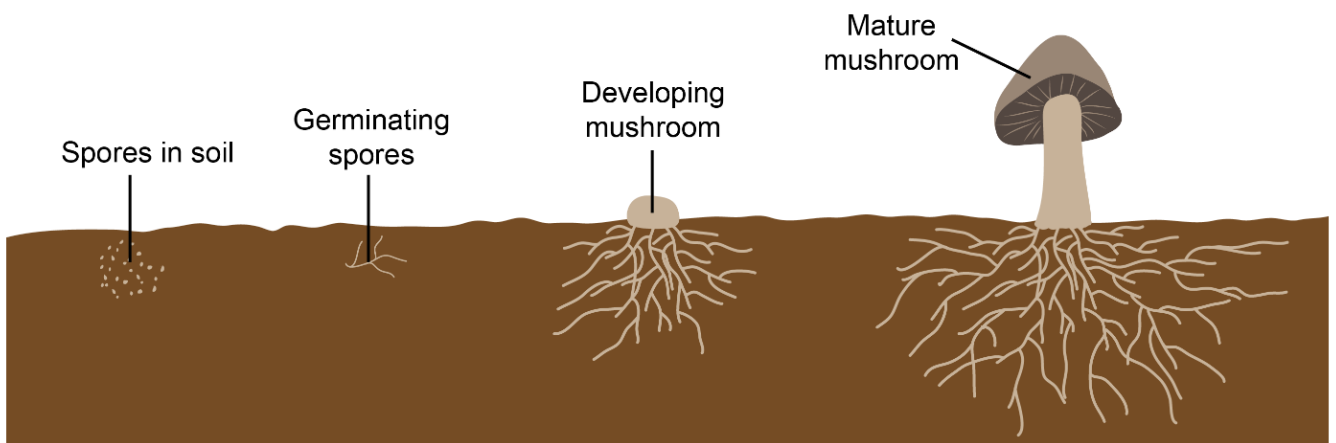
The students noticed that mushrooms were growing in a wide variety of locations around their school. They decided to investigate a factor affecting the growth of mushrooms. They formulated the following research question:

How does temperature affect the growth of mushrooms?

After carrying out some initial research, the students decided to use biomass as a measure of growth. Biomass is the total mass of living organisms not including the water they contain.



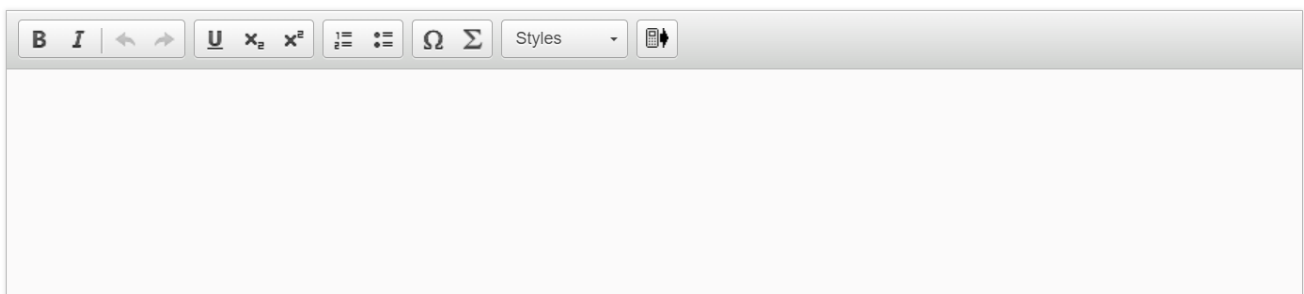
After carrying out some initial research, the students decided to use biomass as a measure of growth. Biomass is the total mass of living organisms not including the water they contain.





The students have access to any equipment they need, including soil, mushroom spores, an incubator and a drying oven.

Design an investigation that would allow the students to obtain quantitative data to answer the research question. In your answer, you must include:

- the independent variable, the dependent variable and two control variables
- a testable hypothesis with a scientific explanation
- details of additional equipment needed
- details of how to manipulate, measure or monitor all of the variables
- details of the method to collect sufficient data
- one safety consideration.



A rich text editor toolbar with the following icons from left to right: Bold (B), Italic (I), Undo (left arrow), Redo (right arrow), Underline (U), Subscript (x₂), Superscript (x²), Bulleted List (three horizontal lines with a dot), Numbered List (three horizontal lines with numbers), Link (Ω), Unlink (Σ), Styles (a dropdown menu labeled 'Styles'), and a mobile device icon.

 **Question 7** (10 marks) 

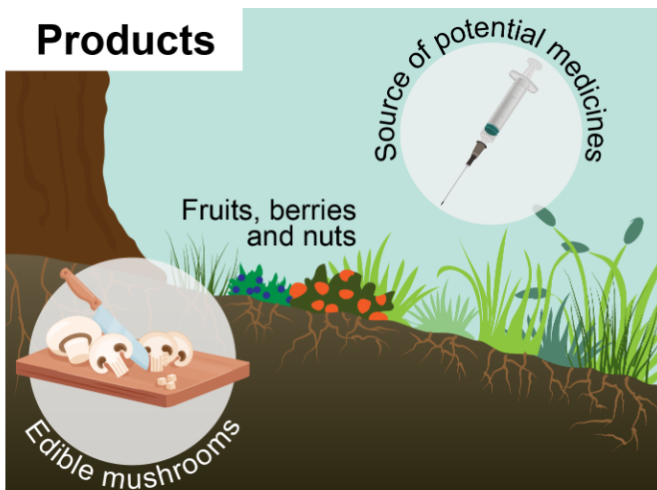
Careful management of ecosystems is essential if global development is to become more sustainable. Decisions and actions made at a local level can have global consequences.

Forest ecosystems cover 31 % of the land area on our planet. Forest ecosystem services are the benefits that forests give to humans and the environment. Forest ecosystem services contribute to human well-being in a variety of ways. They have a huge impact on our survival and quality of life.

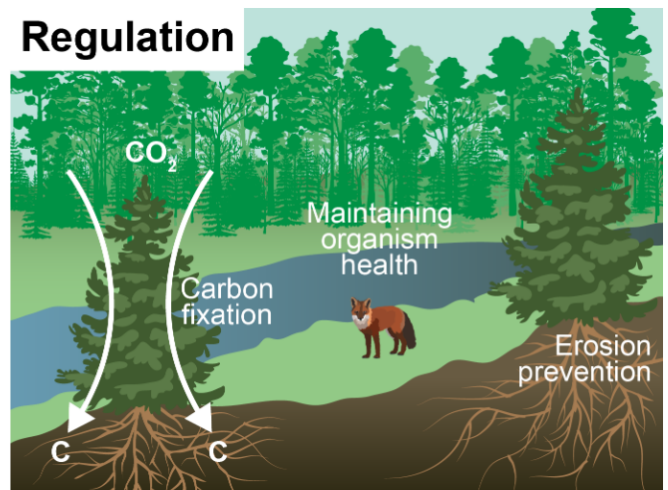
 **Question 7a** (1 mark)

The images below show examples of the four categories of ecosystems service:

Products



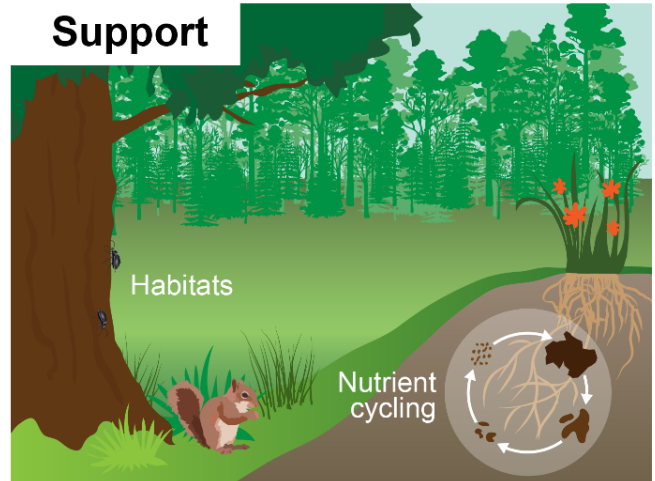
Regulation



Cultural



Support



Complete the table by **selecting** and dragging the ecosystem services.

Draggable items:

Soil formation Recreational activities Purification of water Raw materials

Products	Regulation	Cultural	Support
Fruits and berries	Carbon fixation	Well-being	Nutrient cycling



Question 7c (6 marks)

One consequence of a growing global population is an increased demand for food. Additional farmland is needed to meet this demand. This farmland can be produced through deforestation, where existing trees are cut down. Valuable raw materials are removed, and the remains are often burned to clear the land. This is an example of a local action with a global consequence.



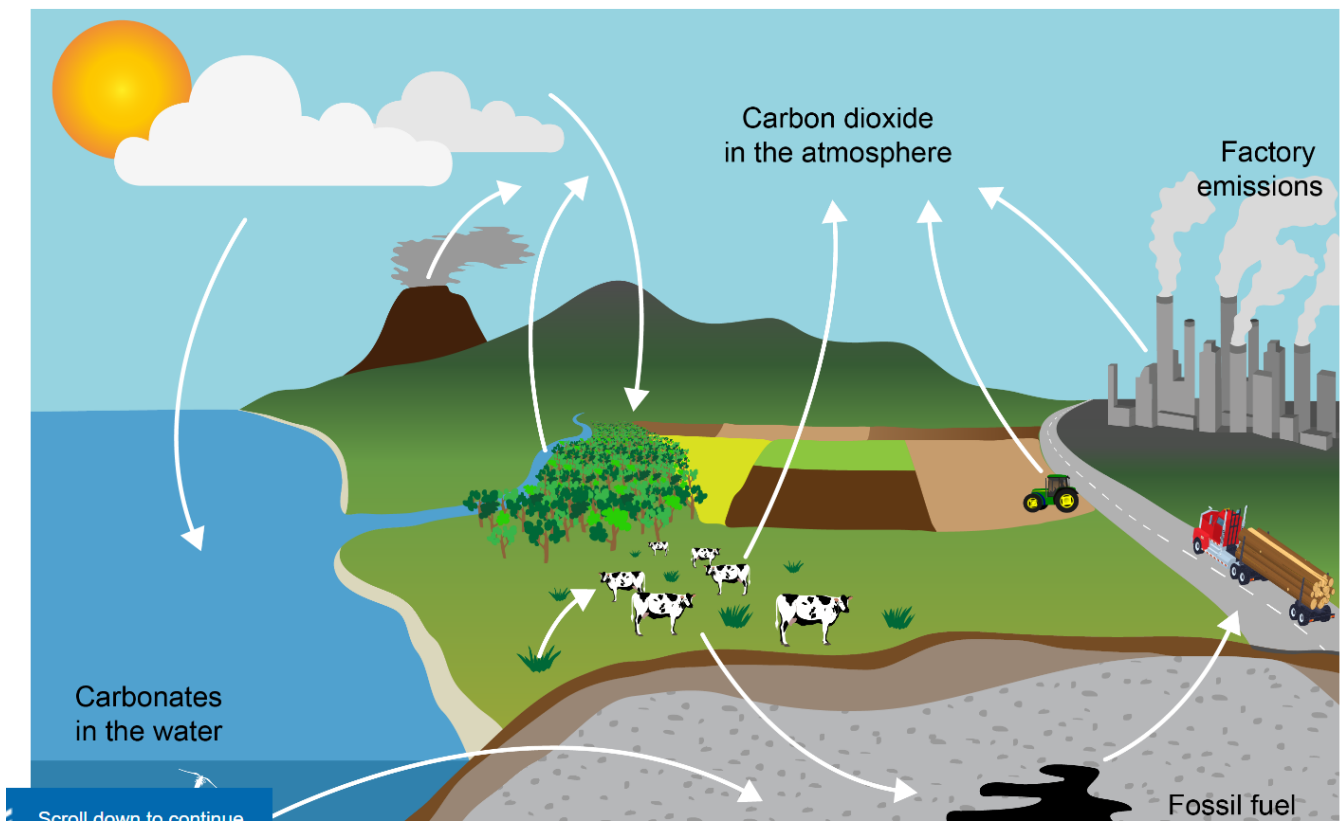


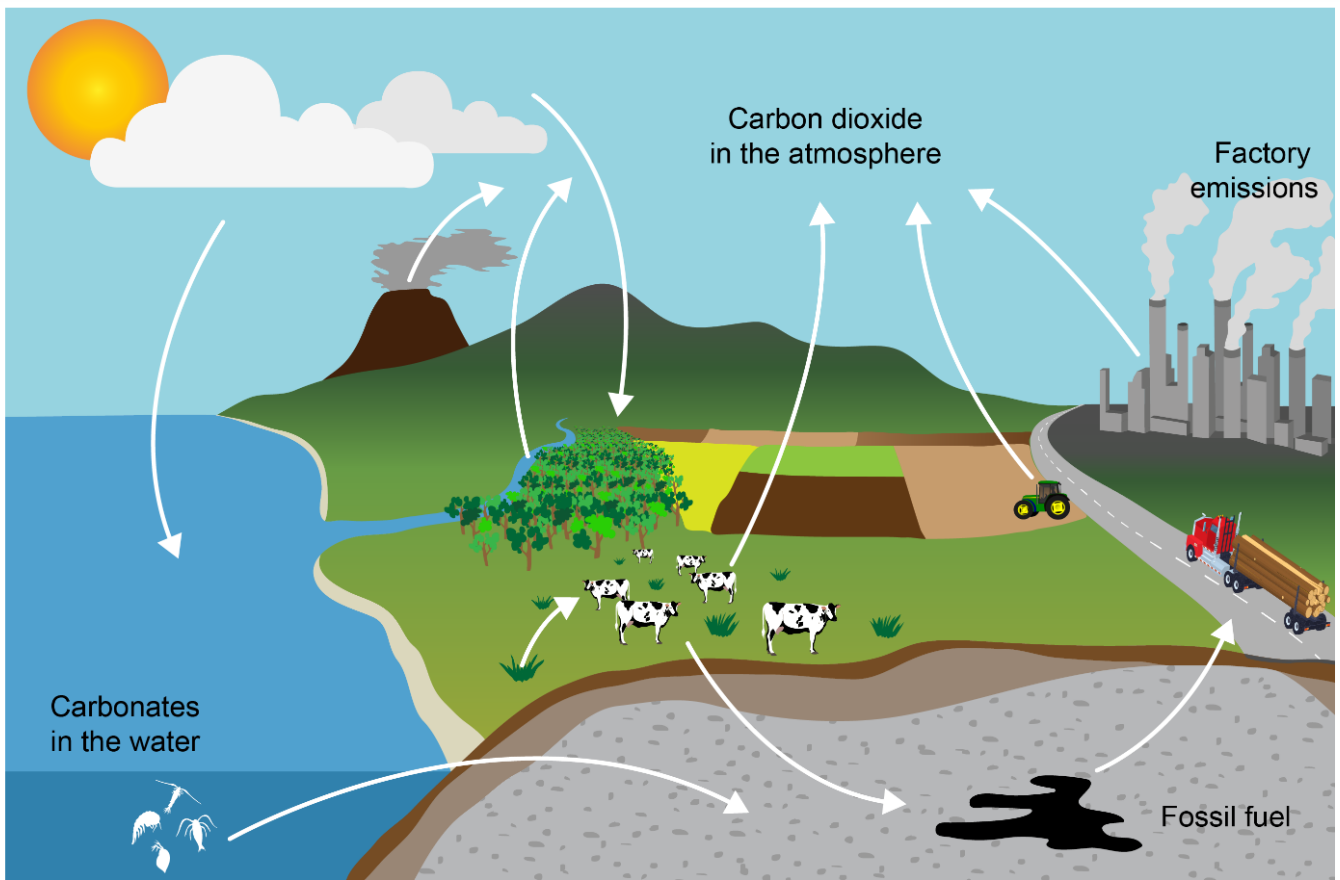




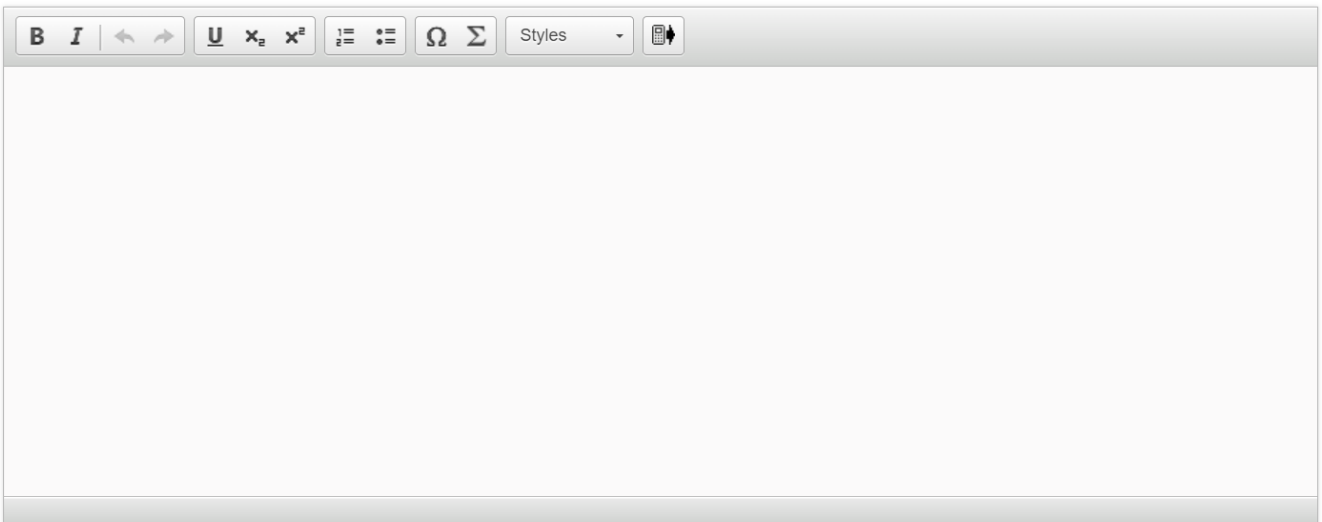


The image below shows the carbon cycle.





Using the image, **discuss** the consequences of deforestation on the **carbon cycle**.



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Question 7d (1 mark)

Increased deforestation has also been linked to global warming and climate change. **Suggest** one other **environmental** consequence of deforestation.

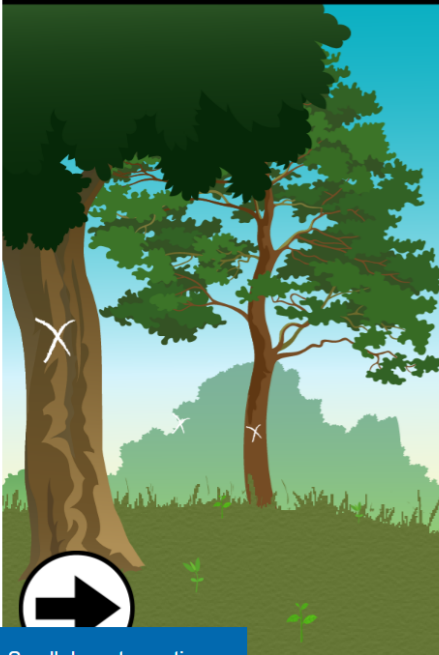
B **I** | ← → | x₂ x² | ☰ ☷ | Ω Σ | Styles ▾ | 📄 ↕

 **Question 8** (16 marks)

Forests can be regenerated for different purposes using a range of methods. The three main methods of regeneration are shown in the interactive media below.

Natural regeneration

Natural regeneration relies on older trees left on the land to provide seeds to regenerate the site.



Direct seeding

Direct seeding is when the landowner applies a known quantity of seeds directly to the land.



Planting seedlings

Planting seedlings is when seedlings are grown in tree nurseries and later planted at the site.



Scroll down to continue

Natural regeneration

The healthiest trees are identified and selected as seed trees before the forest is cut down. Just before they release seeds, the rest of the trees are cut down. Care must be taken to ensure that the seed trees are not damaged by machinery.



Scroll down to continue

Natural regeneration

To give the seeds the best chance of germinating and growing, the soil must be prepared by adding nutrients.



Natural regeneration

Weeds are removed, and herbicides may be applied.



Scroll down to continue

Natural regeneration

The site must be managed to optimize growth.



Natural regeneration

After 1–2 years, the seed trees are removed, and the growth of the new trees is monitored.



Scroll down to continue



Natural regeneration

9
years



MENU

Direct seeding

To give the seeds the best chance of germinating and growing, the soil must be prepared by adding nutrients.



Direct seeding

Weeds are removed, and herbicides may be applied.



Direct seeding

Seeds to be planted must be stored below 2°C. The number of seeds needed varies by species and the conditions of the site.



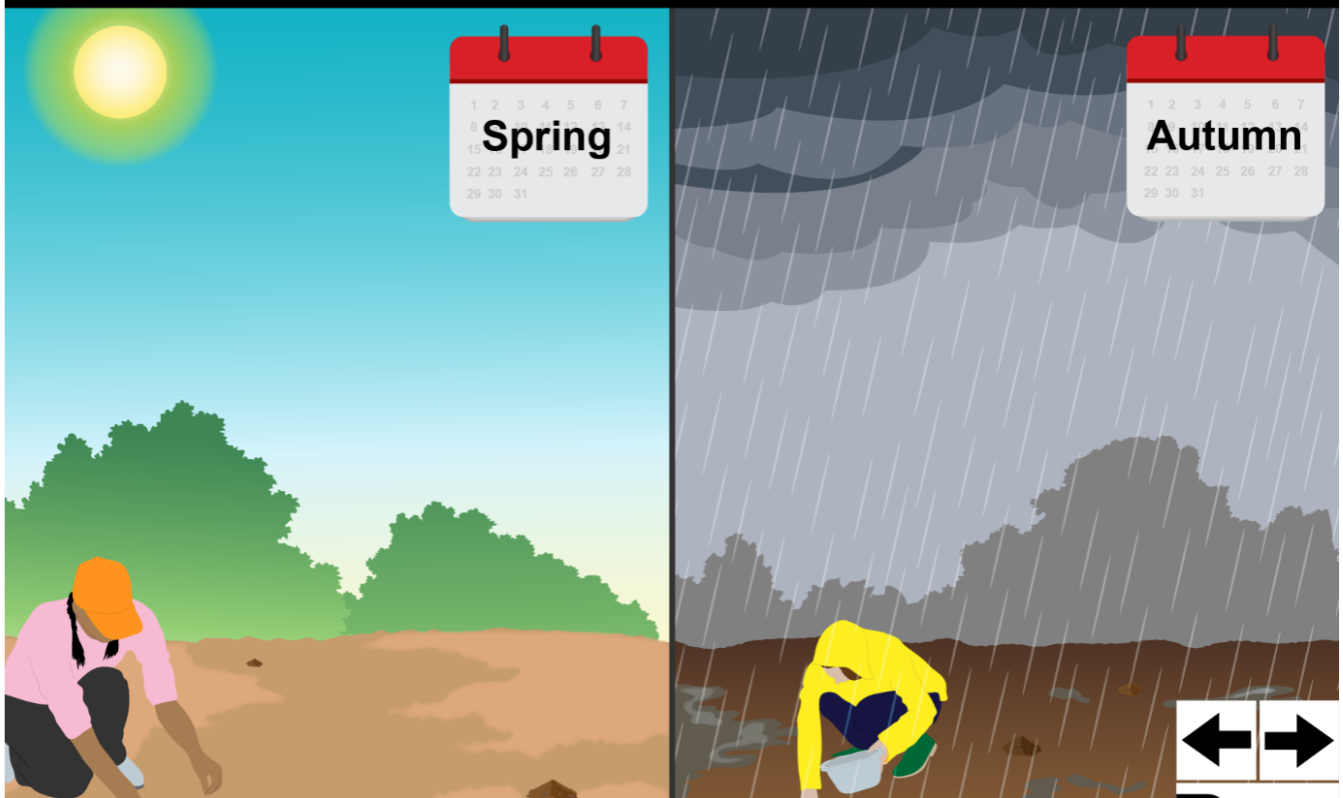
Scroll down to continue

Seeds are treated to increase germination and survival rate.



Direct seeding

Different seeds must be planted at different times of the year.



Direct seeding

For large or inaccessible areas, seeds may be planted using an airplane.



For smaller plots of land, seeds may be planted by hand.



Direct seeding

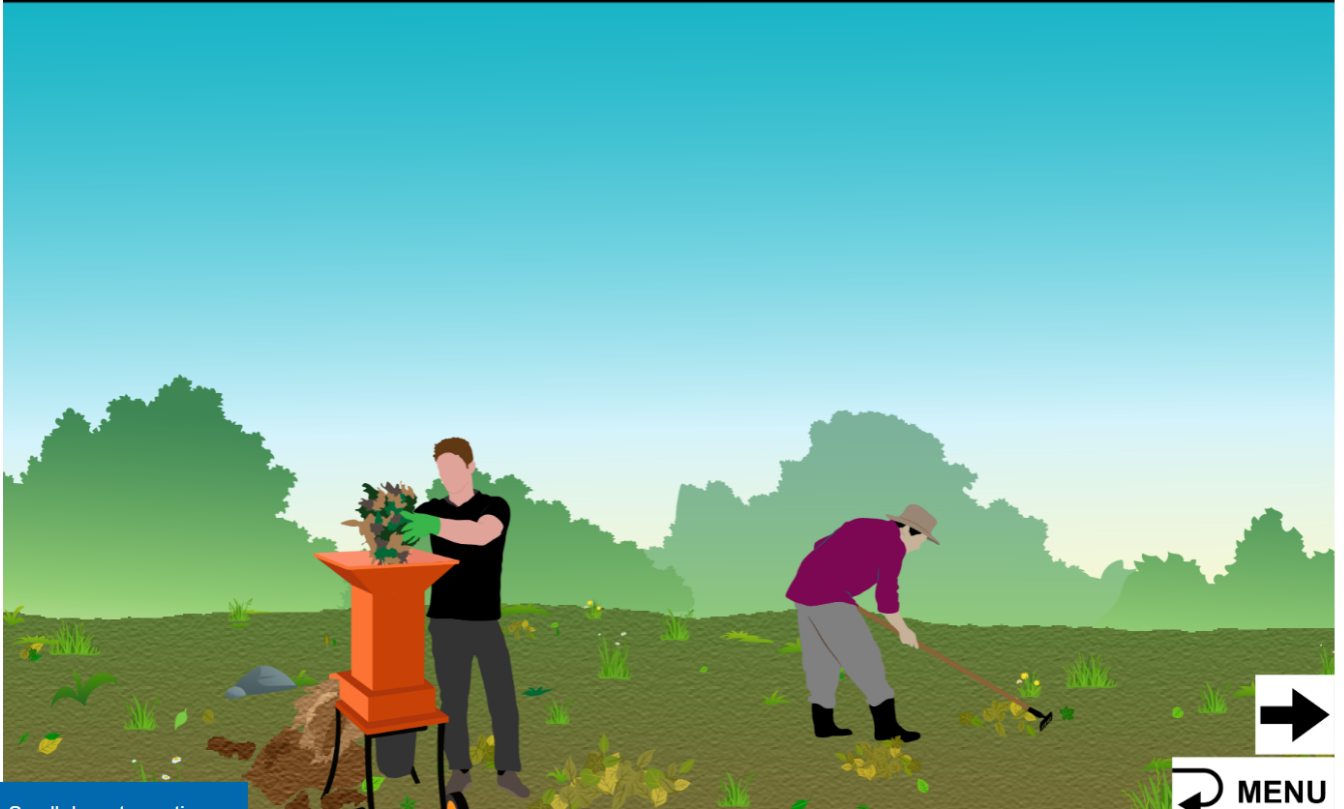
8
years



MFNII

Planting seedlings

To give the seedlings the best chance of growing, the soil must be prepared by adding nutrients.



Planting seedlings

Weeds are removed, and herbicides may be applied.



Scroll down to continue

Planting seedlings

Genetically improved seedlings can be selected.
1- to 2-year-old seedlings grow best if planted directly after harvesting.



Planting seedlings

Transport to the regeneration site must be in a closed or refrigerated vehicle.



Planting seedlings

Trees are often planted in rows, with even spaces between them. Seedlings can be planted by hand or machine.



Hand

2 people

1000 – 2000

trees planted per day



Machine

2 people

8000 – 10 000

trees planted per day



Scroll down to continue

Planting seedlings

Seedlings require more care than seeds, including regular watering.



Scroll down to continue

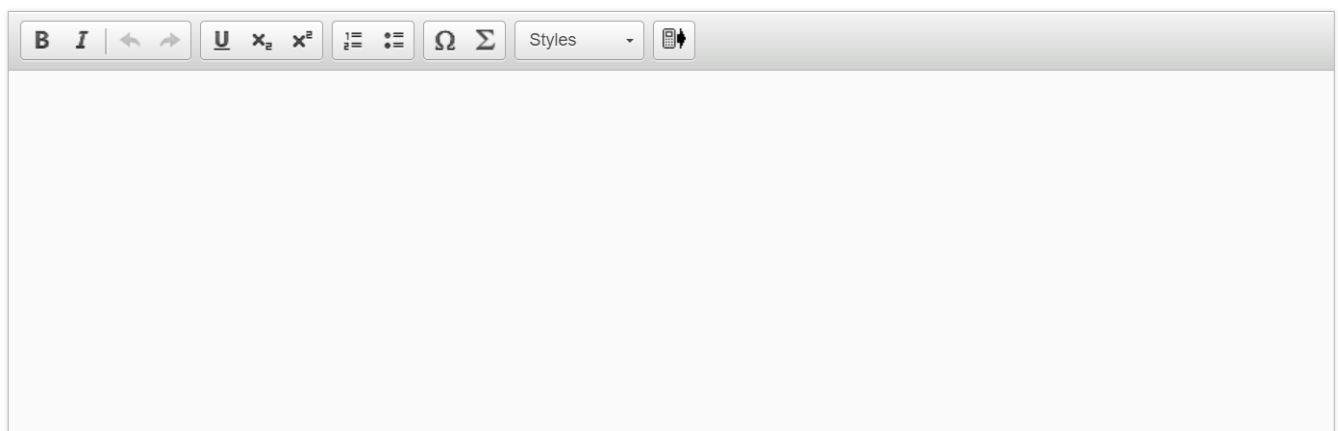
Planting seedlings



Scroll down to continue

Using information from this task and your wider MYP studies, **discuss** and **evaluate** the different methods for forest regeneration. In your answer, you must include:

- two reasons to regenerate forests
- a scientific explanation of why planning for regeneration is important
- a discussion of different environmental consequences for two methods
- a discussion of different economic considerations for two methods
- a concluding appraisal justifying your opinion of which is the best method of regeneration.



A rich text editor toolbar with the following icons from left to right: Bold (B), Italic (I), Undo (left arrow), Redo (right arrow), Underline (U), Subscript (x₂), Superscript (x²), Bulleted List (three horizontal lines with dots), Numbered List (three horizontal lines with numbers), Link (Ω), Unlink (Σ), Styles (dropdown menu), and a Help icon (hand with arrow).