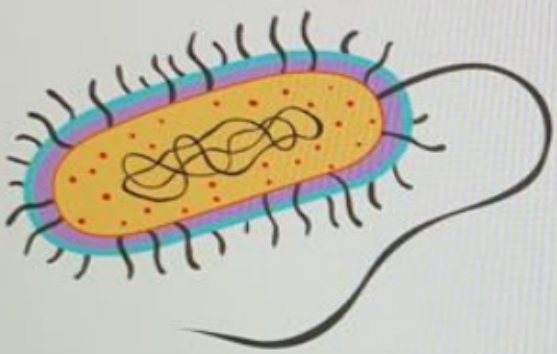
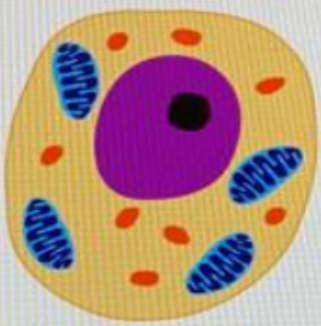
Question 1 (14 marks)

Question 1a (2 marks)

The images show a bacterial cell and an animal cell.



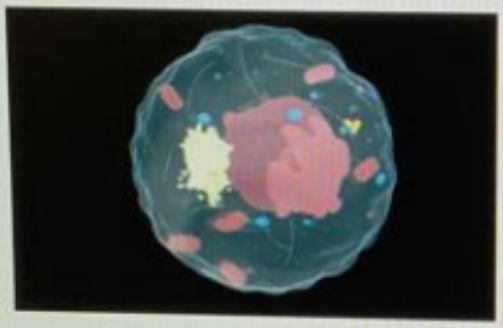


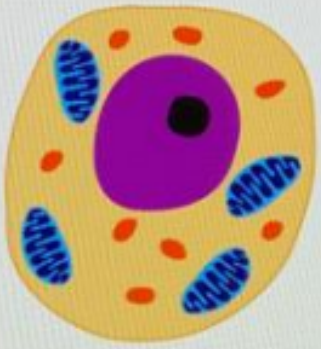
The table below lists some features of cells. **Identify** which feature is present in each type of cell.

	Bacterial cells	Animal cells
Mitochondria		
Cell wall		
Cell membrane		
Nucleus		

Question 1b (2 marks)

Scientists use models to help them visualize smaller parts and relationships within systems. The images below are two different models of animal cells.





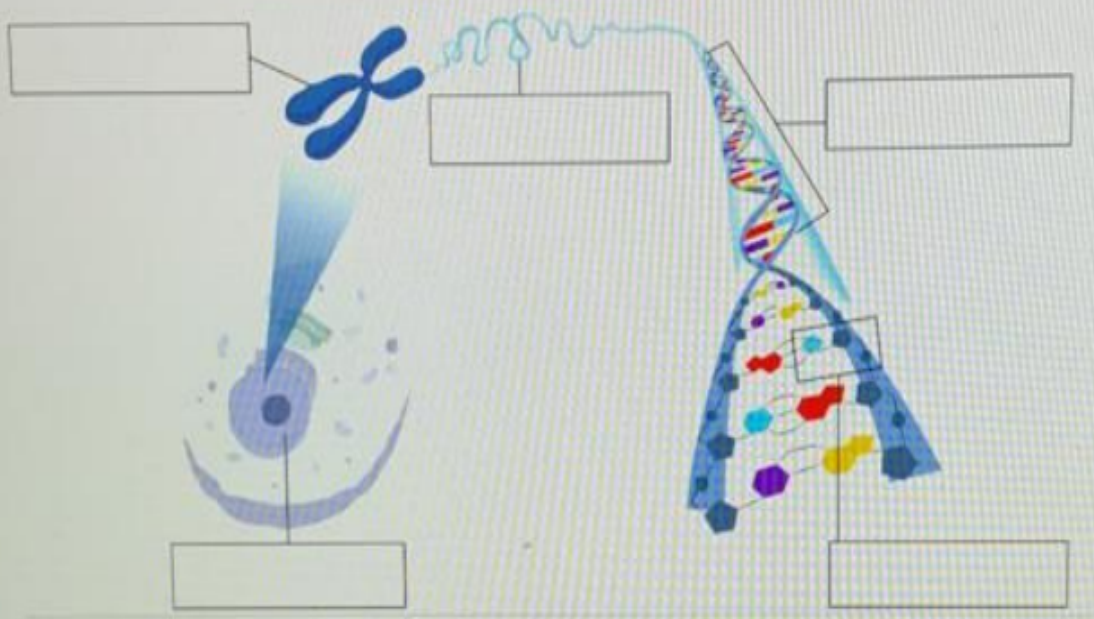
Outline two advantages of the three-dimensional (3D) model of the cell.

Question 1c (2 marks)

Label the diagram below.

Draggable labels:

- Chromosome
- DNA
- Gene
- Nucleus
- Nucleotide



A gene carries information for a trait which can be passed on from a parent to a child. Having dimples is one example of a trait. Dimples are a result of a dominant allele (D) whereas not having dimples is a result of a recessive allele (d).

The father of a child has dimples (Dd) and the mother does not have dimples.

State the genotype of the mother.

Question 1e (2 marks)

Use the symbols D and d to complete the table and **determine** the possibility that the child has dimples.

		Father's alleles	
		D	d
Mother's alleles			

Reset

Possibility that the child has dimples

B I U x_2 x^2 Ω Σ Styles

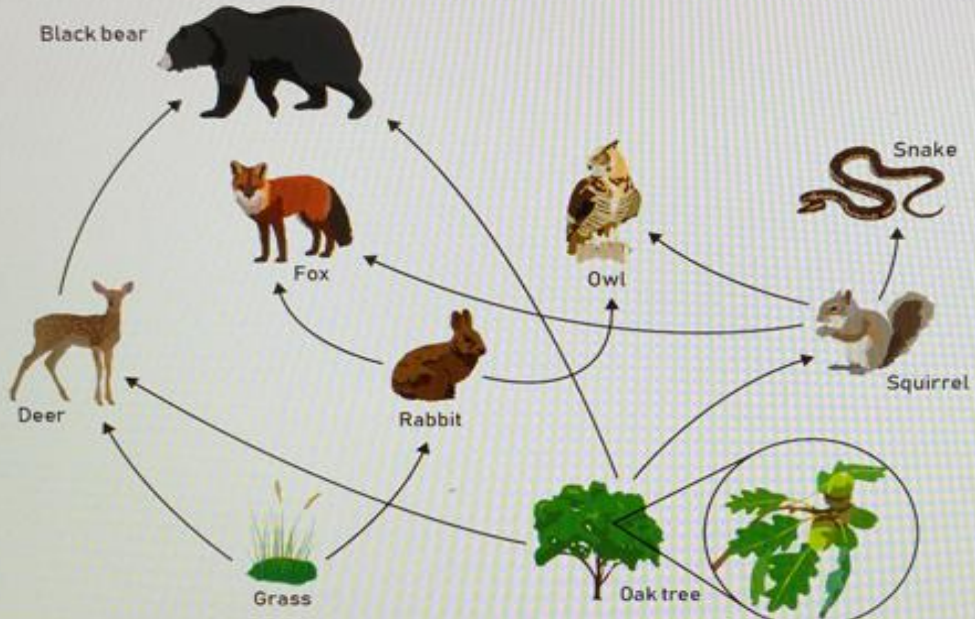
Question 1f (5 marks)

Variation is the difference between individuals of a species. **Explain** why variation is important for the survival of a species.

B I U x_2 x^2 Ω Σ Styles

Question 2 (6 marks)

The food web below shows interactions between organisms in a forest.



A producer

An omnivore

A primary consumer

Question 2b (2 marks)

Humans built a large housing development in the forest which is the habitat of the foxes. The foxes now use human trash as a source of food.

Outline how the population of foxes could be affected by this change.

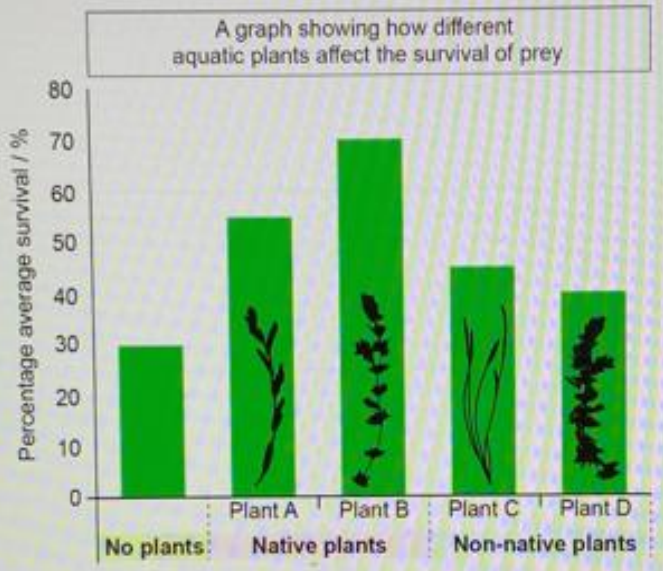
Outline how the population of foxes could be affected by this change.

Question 2c (3 marks)

Use your answer to part (b) to **describe** how the deer population would then be affected.

Aquatic plants are useful for many types of experiments.

The graph below shows the results from an investigation into how different plants affect the ability of small aquatic animals to hide from their predators. The experiment was done in a water tank with controlled numbers of plants, prey and predators.



Question 3a (1 mark)

Identify the plant that resulted in the highest percentage average survival for the prey.

Question 3b (1 mark)

Suggest a reason for your answer to part (a).

Question 3c (2 marks)

Compare and contrast the results for native and non-native plants.

Question 3c (2 marks)

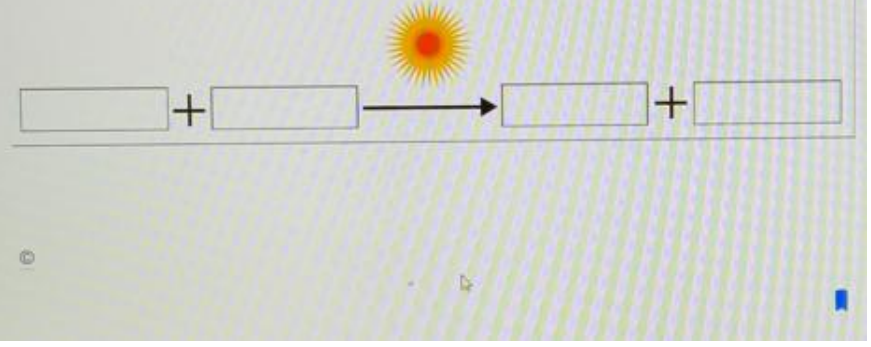
Compare and contrast the results for native and non-native plants.

Question 3d (1 mark)

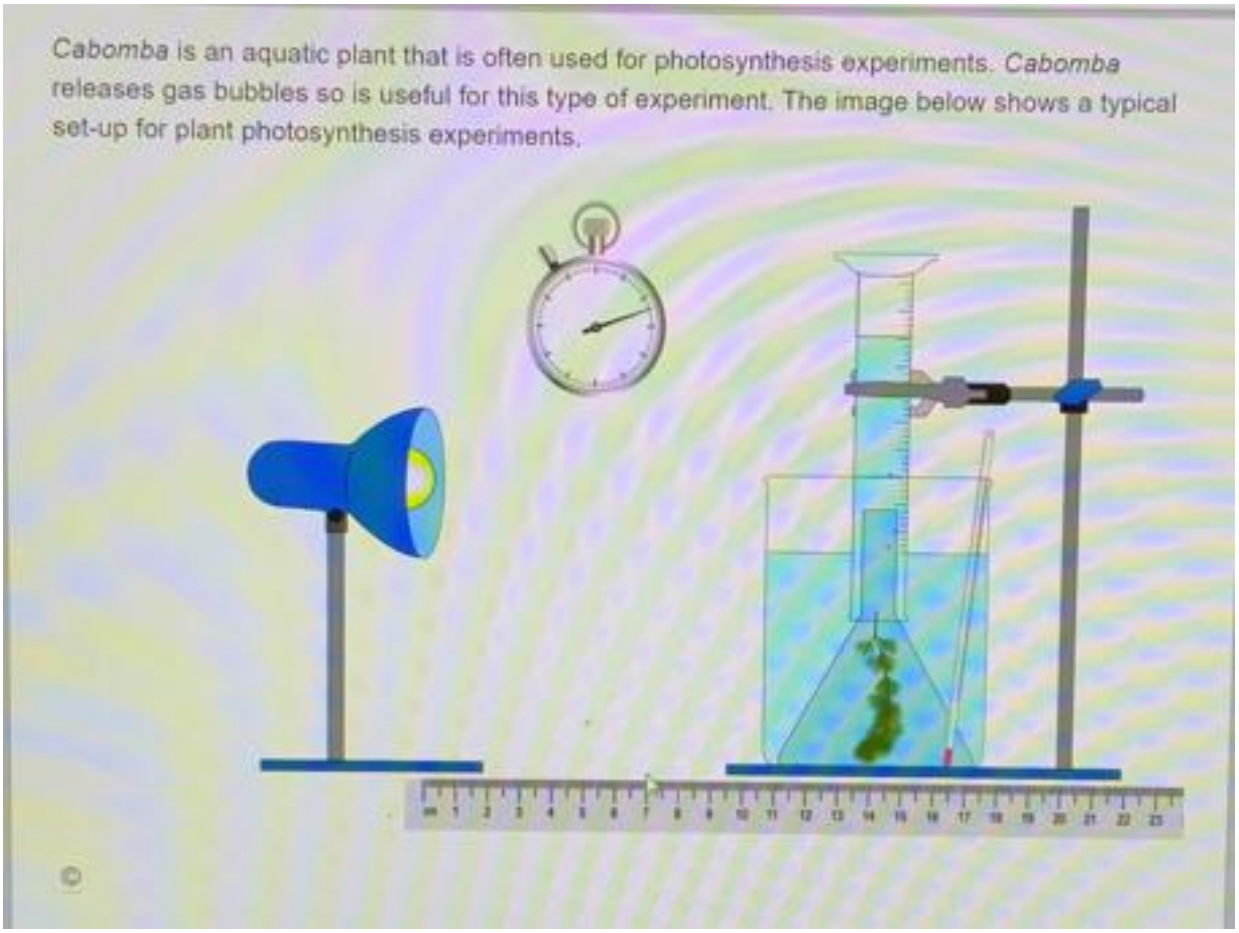
State why the effect of having no plants was also tested.

Select the correct location for each word to show the equation for photosynthesis.

Draggable items: Carbon dioxide | Glucose | Oxygen | Water



Cabomba is an aquatic plant that is often used for photosynthesis experiments. *Cabomba* releases gas bubbles so is useful for this type of experiment. The image below shows a typical set-up for plant photosynthesis experiments.



Identify the variables in this investigation.

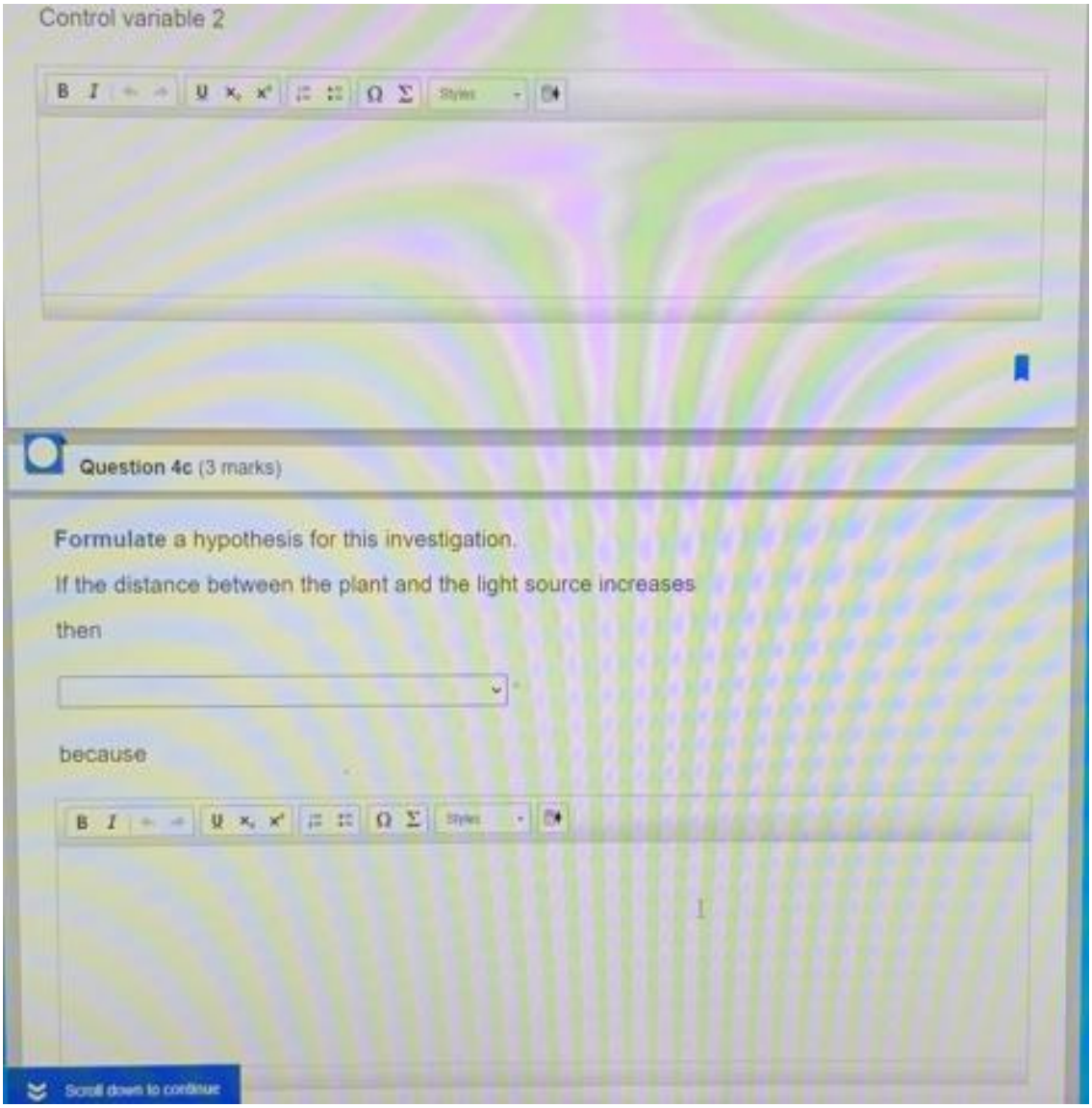
Independent variable

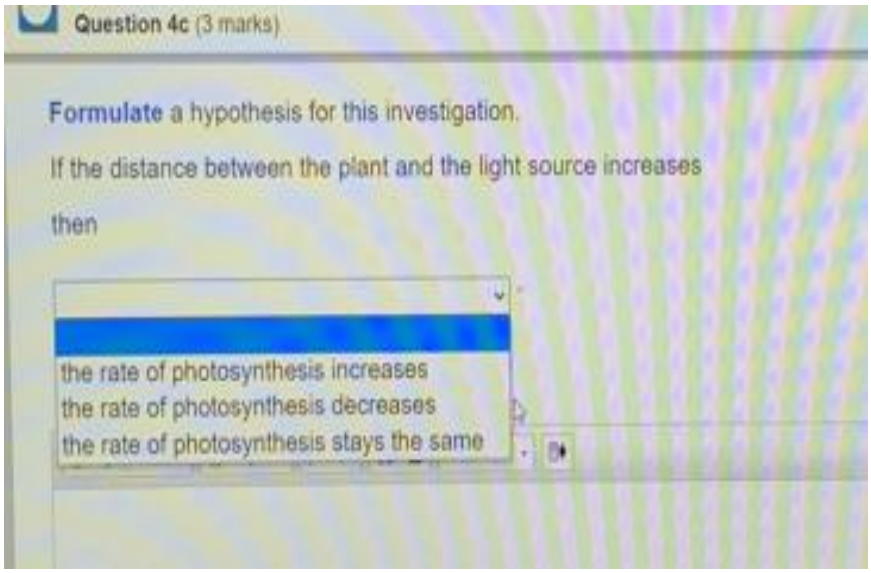
Dependent variable

Control variable 1

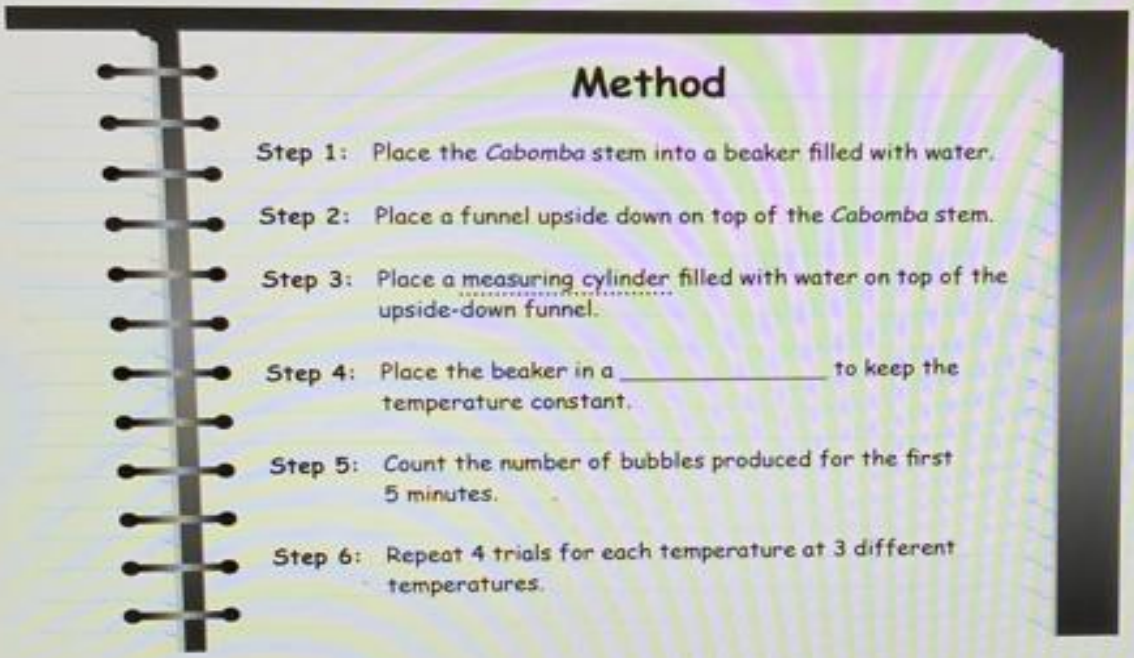
Control variable 2

Scroll down to continue


Control variable 2
Question 4c (3 marks)
Formulate a hypothesis for this investigation.
If the distance between the plant and the light source increases
then
because
Scroll down to continue


Question 4c (3 marks)
Formulate a hypothesis for this investigation.
If the distance between the plant and the light source increases
then
the rate of photosynthesis increases
the rate of photosynthesis decreases
the rate of photosynthesis stays the same

A student investigated the effect of temperature on the rate of photosynthesis in *Cabomba*. The notes below are taken from the student's laboratory notebook.



Method

Step 1: Place the *Cabomba* stem into a beaker filled with water.

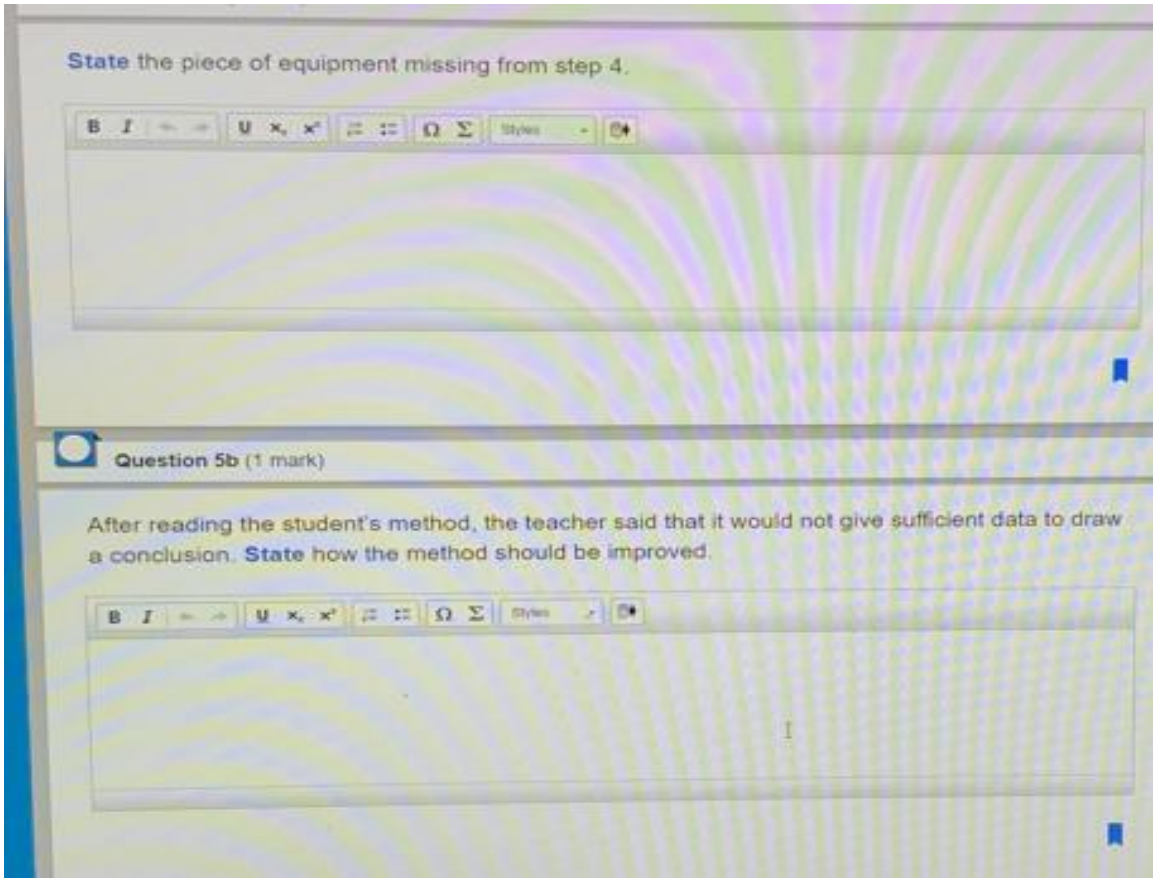
Step 2: Place a funnel upside down on top of the *Cabomba* stem.

Step 3: Place a measuring cylinder filled with water on top of the upside-down funnel.

Step 4: Place the beaker in a _____ to keep the temperature constant.

Step 5: Count the number of bubbles produced for the first 5 minutes.

Step 6: Repeat 4 trials for each temperature at 3 different temperatures.



State the piece of equipment missing from step 4.

Question 5b (1 mark)

After reading the student's method, the teacher said that it would not give sufficient data to draw a conclusion. **State** how the method should be improved.

Question 5c (2 marks)

Justify why the student planned to repeat four trials at each temperature.

Question 5d (1 mark)

State a way to improve the precision of measurements in this investigation using the equipment provided.

Question 5e (3 marks)

The results from the student's investigation are given below. **Calculate** the missing average and show your working in the box below. **State** two improvements to the data **presentation**.

Temperature	Number of gas bubbles produced in 5 minutes				
	Trial 1	Trial 2	Trial 3	Trial 4	Average
20	5	7	5	7	
40	6	13	14	12	11.25
50	2	1	2	1	1.5

Average

Improvement 1

Improvement 2

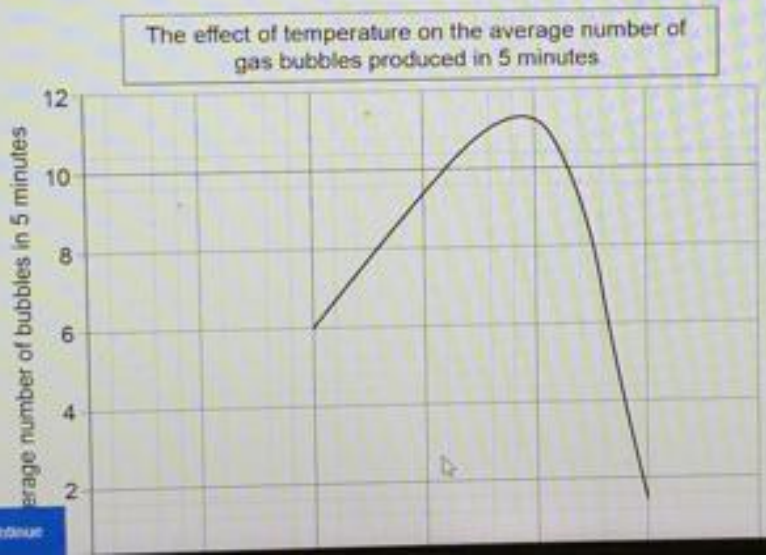
Question 5f (1 mark)

One of the results in the data table above appears to be an outlier. **Identify** the data point that is an outlier.

Suggest how to analyse data that has an outlier.

Question 5h (2 marks)

The graph below shows the effect of temperature on the average number of gas bubbles produced in 5 minutes.



Scroll down to continue

The student hypothesized:

> If the temperature increases, then the average number of gas bubbles will increase, because molecules involved in photosynthesis are moving faster.

Using the graph, **outline** the validity of this hypothesis.

Question 5i (3 marks)

Explain the reason for the sharp decrease in the average number of gas bubbles.

Design an investigation to test how changing the length of a *Cabomba* stem affects the rate of photosynthesis. You are provided with standard laboratory equipment. In your answer, you should include:

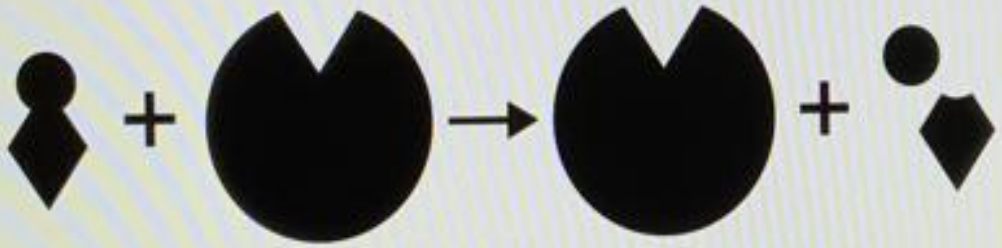
- the independent variable, dependent variable and two control variables
- a testable hypothesis
- equipment you will use
- details of how to manipulate, measure or monitor the variables
- details of the method to collect sufficient data.

Question 7 (7 marks)

The enzyme that catalyses the photosynthesis reaction is called rubisco. Enzymes are affected by different factors, including temperature and concentration of substrate.

Question 7a (2 marks)

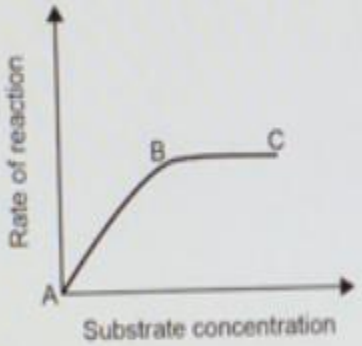
The diagram below illustrates an enzyme-catalysed reaction. **Identify** the enzyme, the substrate and the product.



Carbohydrate
Enzyme
Product
Substrate

Question 7b (4 marks)

The graph below shows what happens to the rate of an enzyme-catalysed reaction when the substrate concentration changes. All other variables were controlled.



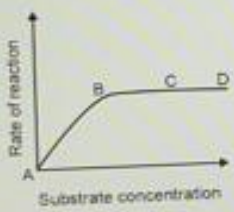
Interpret the graph and **explain** the trend between each set of points.

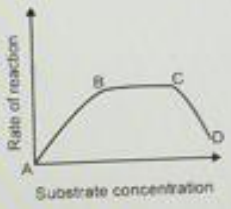
Between points A and B

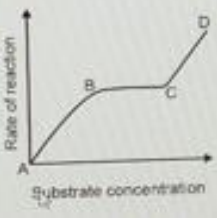
Between points B and C

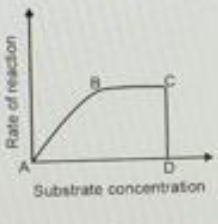
Question 7c (1 mark)

Select the graph that shows the effect of adding more enzyme at point C.









Question 8 (9 marks)

Stress can lead to health problems. The video below explores one health problem related to stress.

Video Video transcript

MYP students often experience pressure to perform, and we call this "work-stress". In everyday life situations, the body's response to stress is beneficial.

Effects such as raised blood pressure and increased breathing rate help the body to be alert and increase focus. But, too much work-stress can affect a person's health in a negative way.

Symptoms of this kind of work-stress are general tiredness, lack of focus, sore eyes and trouble sleeping.

When people go to a doctor with stress-related symptoms, the doctor may advise them to eat a healthy diet and exercise every day.

Long-term exposure to stress may result in continuous high blood pressure. The medical term for this is hypertension. Hypertension increases the risk of serious health problems, including heart attack and stroke.

Once hypertension is diagnosed, often the first advice to lower the blood pressure is to make lifestyle and dietary changes. Often exercise is prescribed.

Medication can also be used to lower the blood pressure. One type of medication works by stopping the blood vessels from contracting. Side effects of this medication are rare, but can include headache and a dry cough.

The number of people who have hypertension is increasing worldwide. It is predicted that, by 2025, 29% of the total population will be affected. The sales of medication will also increase. However, medical experts warn that medication may be prescribed too easily.

Question 8a (2 marks)

One of the effects of stress is a temporary increase in blood pressure. **Outline** how arteries are better able to withstand high pressure than veins.

B I U x_2 x^2 Ω Σ Styles

Question 8b (4 marks)

Exercise can be prescribed to reduce hypertension. Besides reducing blood pressure, **suggest** two more advantages and two disadvantages to health from exercise.

Advantage 1

B I U x_2 x^2 Ω Σ Styles

Advantage 2

B I U x_2 x^2 Ω Σ Styles

Scroll down to continue

Question 8b (4 marks)

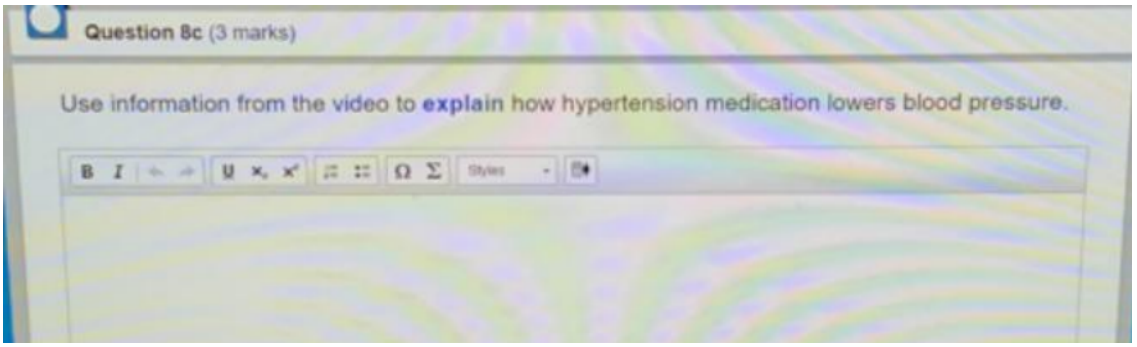
Exercise can be prescribed to reduce hypertension. Besides reducing blood pressure, **suggest** two more advantages and two disadvantages to health from exercise.

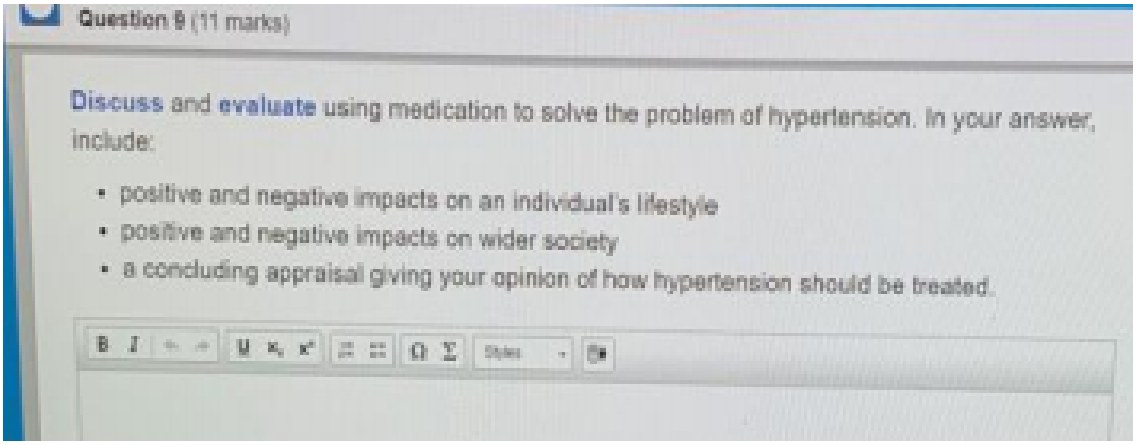
Advantage 1

Advantage 2

Disadvantage 1

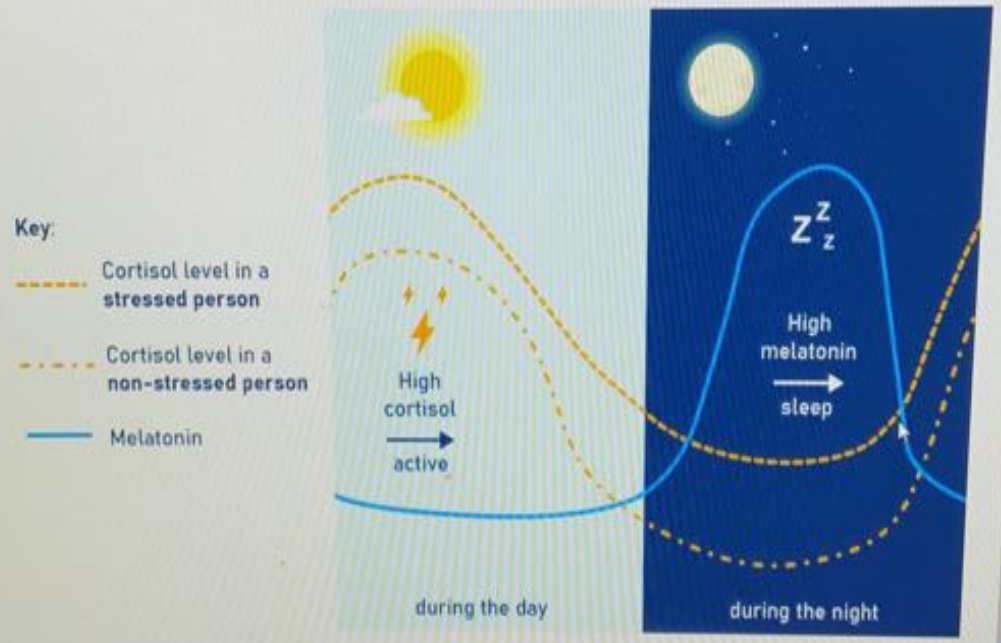
Disadvantage 2


Question 8c (3 marks)
Use information from the video to explain how hypertension medication lowers blood pressure.


Question 9 (11 marks)
Discuss and evaluate using medication to solve the problem of hypertension. In your answer, include:
• positive and negative impacts on an individual's lifestyle
• positive and negative impacts on wider society
• a concluding appraisal giving your opinion of how hypertension should be treated.

Question 10 (8 marks)

Melatonin and cortisol are hormones naturally released by the human body to regulate the sleep-wake pattern. The graph below shows the changes in hormone levels for a non-stressed person and a stressed person during the day and during the night. The balance between the two hormones determines how easy it is to fall asleep.

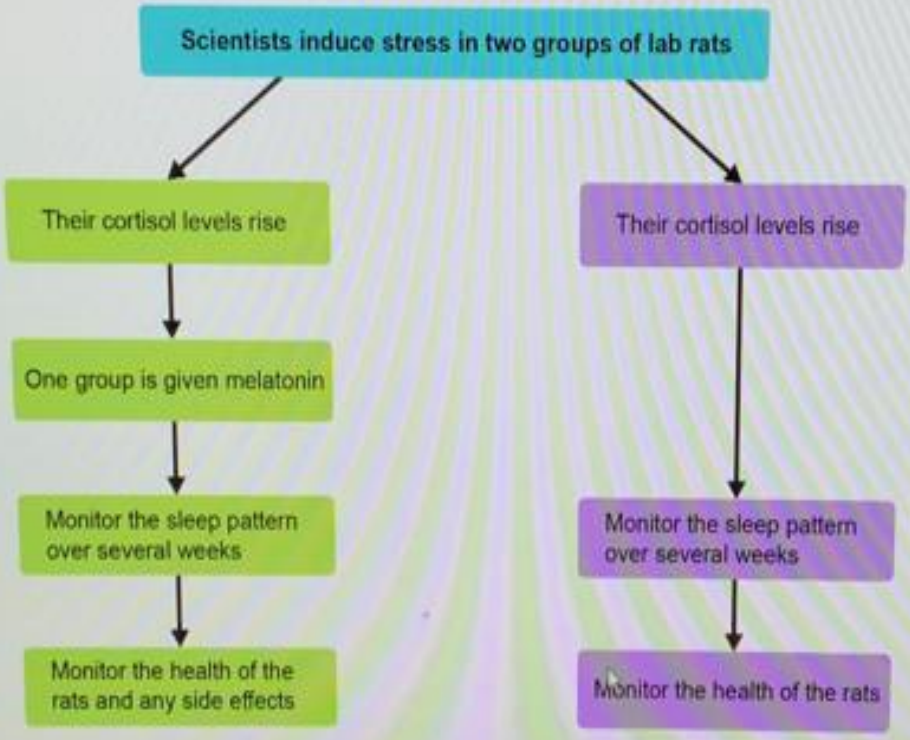


Question 10a (2 marks)

People with sleeping problems due to stress sometimes take a melatonin pill to fall asleep. **Suggest** how this would help them to fall asleep.

Question 10b (6 marks)

The effect of taking melatonin regularly is unknown. To find out the long-term effects, scientists would have to conduct studies on animals. The diagram below shows a study into the effect of melatonin on lab rats.



Discuss and **evaluate** the use of rats to test the long-term effects of melatonin to treat sleep problems in humans. In your answer, you should include:

- a benefit and a limitation of using lab rats
- two ethical considerations
- a concluding appraisal with justification.