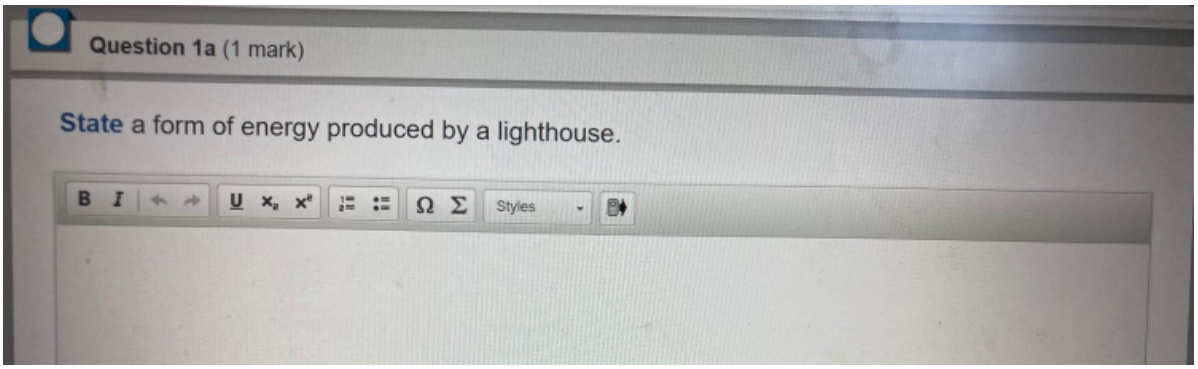
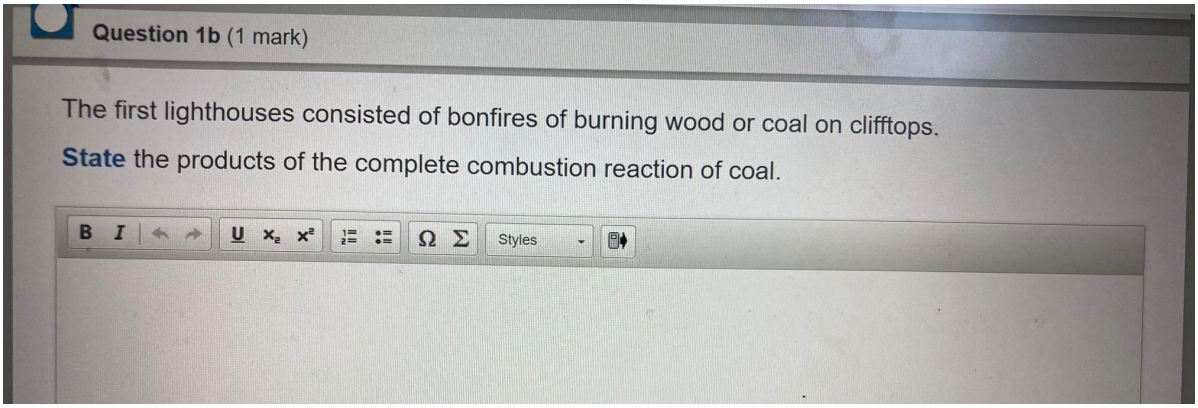
Integrated Science e-assessment
May 2019

Lighthouses have been used to help sailors travel safely since ancient times. For example, a lighthouse might be located on dangerous rocks, or a group of several lighthouses with different patterns of light flashes might guide ships through a narrow channel.


Question 1a (1 mark)
State a form of energy produced by a lighthouse.
Styles

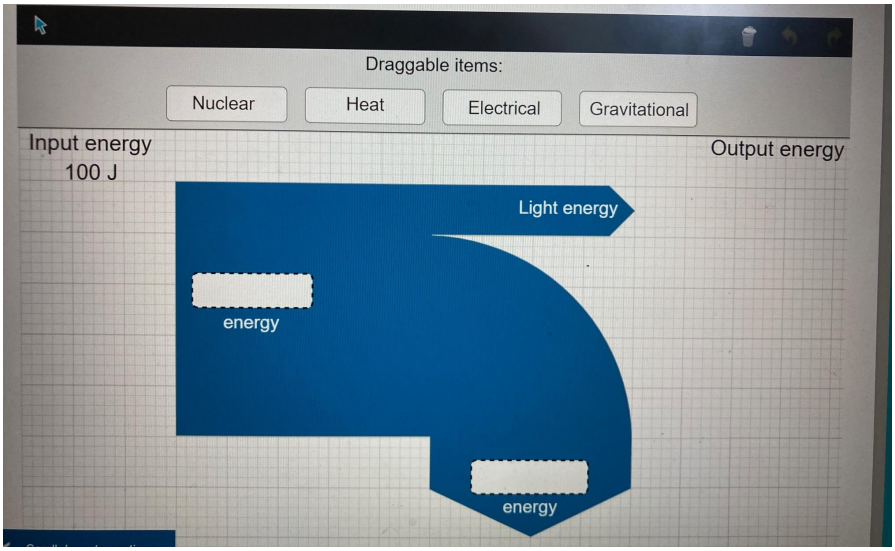

Question 1b (1 mark)
The first lighthouses consisted of bonfires of burning wood or coal on clifftops.
State the products of the complete combustion reaction of coal.
Styles

Question 1c (1 mark)

During the 19th century, lighthouses were converted to use electricity which gave a more reliable light source.

The Sankey diagram below shows the efficiency of a light bulb.

Select the correct energy type to label the arrows.



Question 1d (2 marks)

Use the diagram to **calculate** the light energy output.

Question 1e (4 marks)

In the early 1900s, light bulbs using up to 3000 W (J s^{-1}) were found in some lighthouses.

Calculate the energy used by a 3000 W light bulb in one hour. Give your answer in standard form.

Question 2 (6 marks)

Mercury compounds are a common by-product of industry. Once mercury compounds have been absorbed by living organisms they are very difficult to remove. Living organisms can absorb mercury by eating food contaminated with mercury compounds.

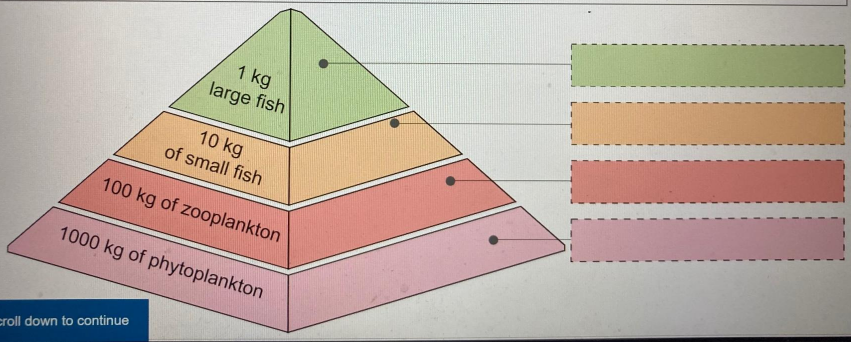
Question 2a (2 marks)

A pyramid of biomass diagram shows the mass of organisms at each stage of a food chain.

Select the trophic level and complete the pyramid of biomass below.

Draggable items:

Producer	Third order consumer	Secondary consumer	Second order consumer	
Herbivore	Primary consumer	Carnivore	First order consumer	Tertiary consumer



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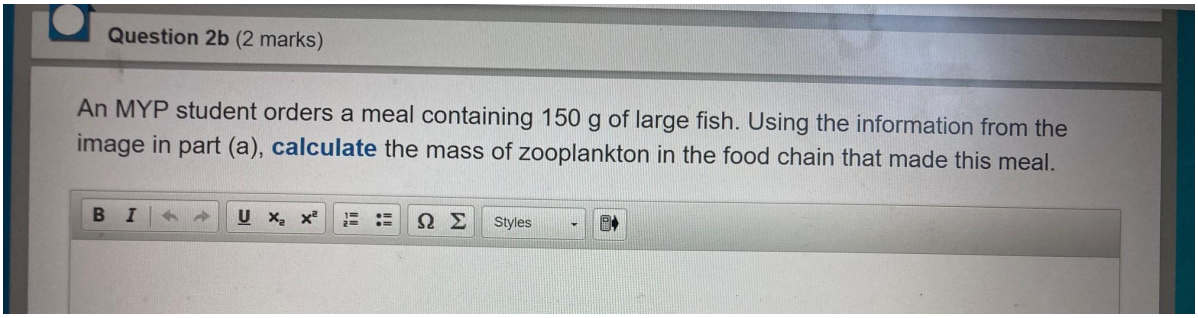
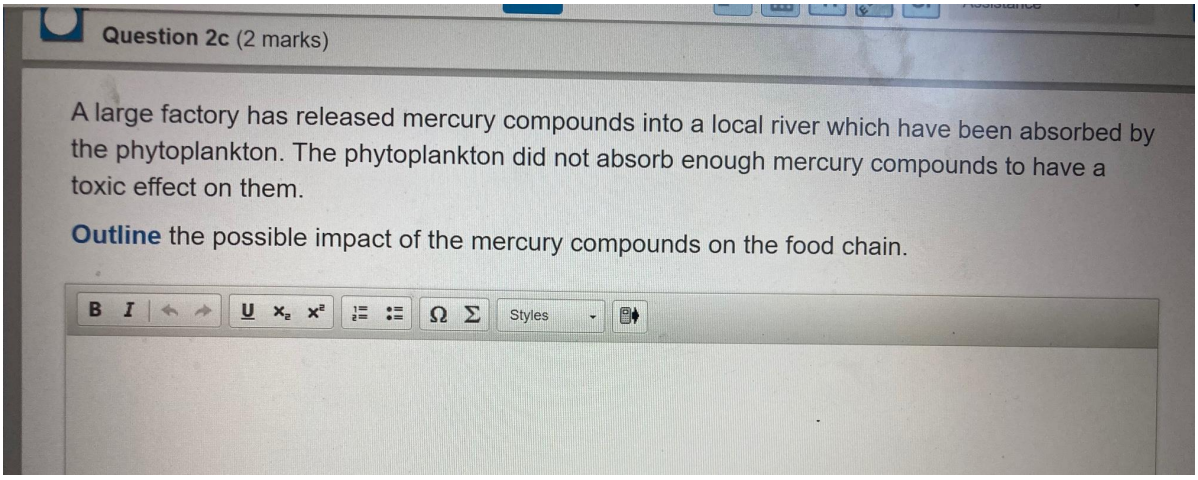
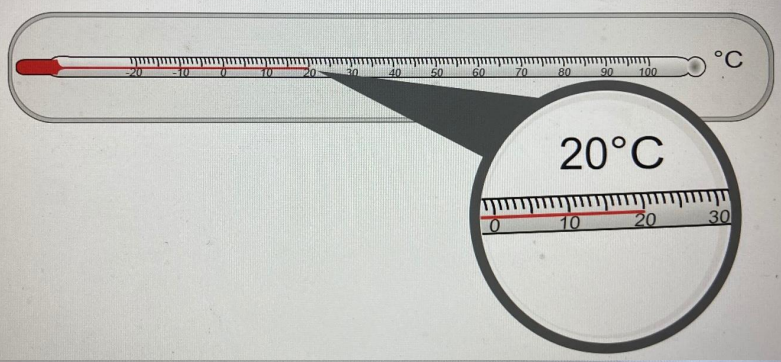

Question 2b (2 marks)
An MYP student orders a meal containing 150 g of large fish. Using the information from the image in part (a), calculate the mass of zooplankton in the food chain that made this meal.
Styles


Question 2c (2 marks)
A large factory has released mercury compounds into a local river which have been absorbed by the phytoplankton. The phytoplankton did not absorb enough mercury compounds to have a toxic effect on them.
Outline the possible impact of the mercury compounds on the food chain.
Styles

Question 3 (10 marks)

A thermometer is an instrument for measuring temperature. The type of thermometer in the image below contains a substance which expands with increasing temperature.



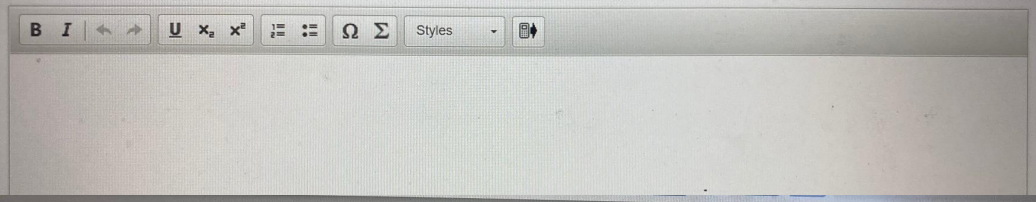
Question 3a (3 marks)

Outline the useful physical properties of the substance in the thermometer shown above.

B I U x_2 x^2 Ω Σ Styles

Question 3b (3 marks)

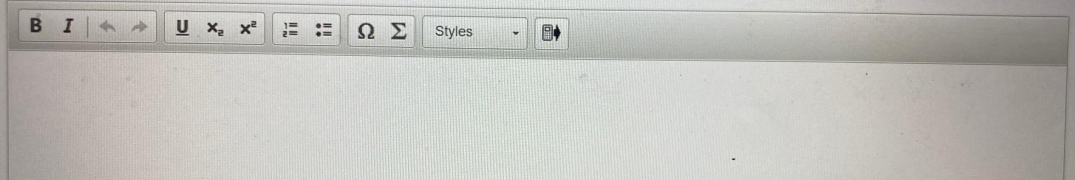
Use your knowledge of particles to **explain** why the substance in the thermometer expands with increasing temperature.

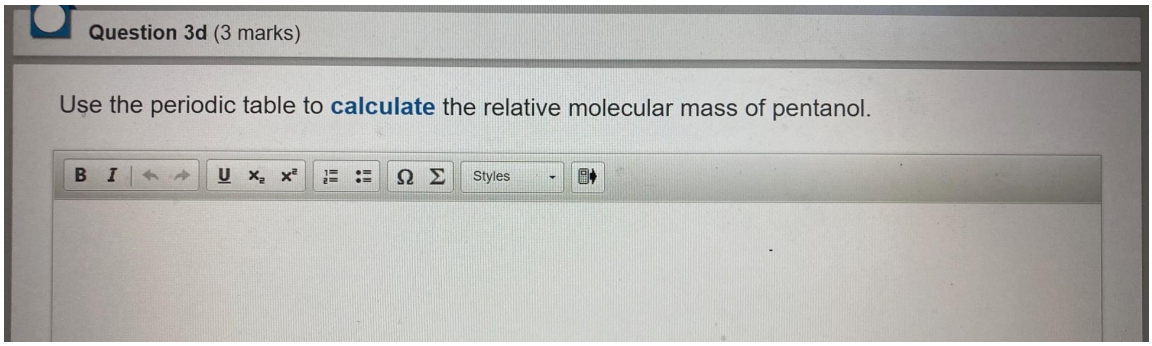


Question 3c (1 mark)

A substance commonly used in thermometers is pentanol which has the molecular formula $C_5H_{12}O$.

State the elements present in pentanol.




Question 3d (3 marks)
Use the periodic table to calculate the relative molecular mass of pentanol.
Styles

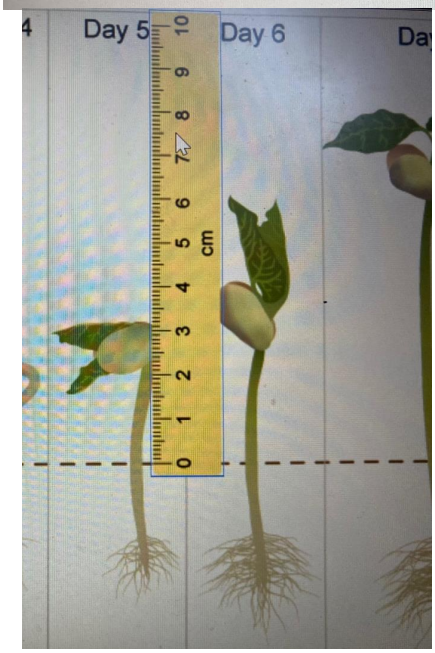
Question 4 (15 marks)

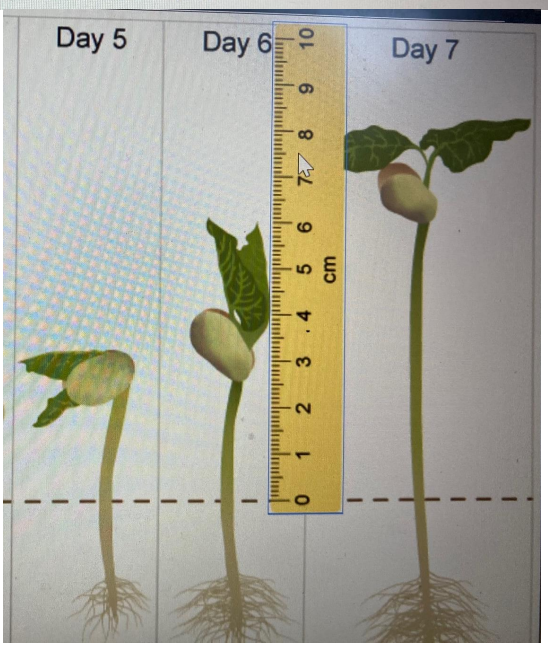
Farming is an important activity in the development of human societies. Food products, fibre for clothes, biofuel, medicinal plants and other products are used to sustain and enhance life. Farming can also help to reduce poverty by raising family incomes for people who live in rural areas.

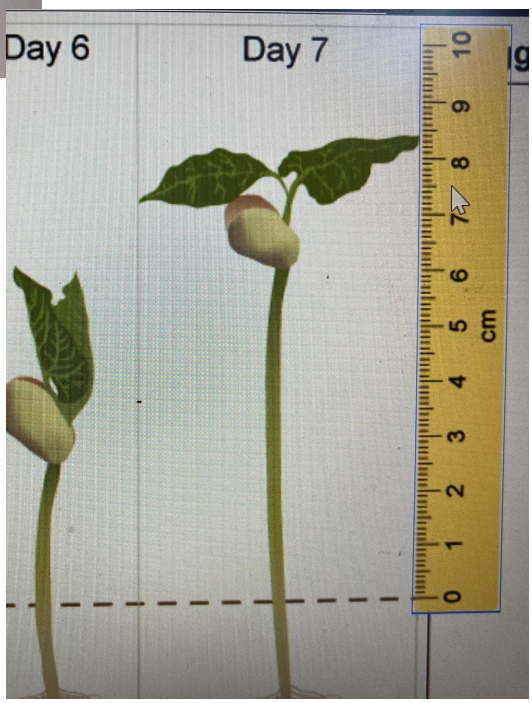
Mung beans are one of the most consumed sprouts and are primarily grown in Asian countries. These plants grow from 45 cm to 1 m tall. Like many other types of seeds, mung beans require specific conditions to germinate and sprout.

Question 4a (4 marks)

A student is investigating the growth of bean sprouts. The student collected data for 3 plants over 7 days. The data for the first 2 plants is given in the table below. **Measure** the height of the third plant for days 5, 6 and 7 and record your values in the table. You should measure the height, from the top of the soil to the highest point of the plant.







Time / days	Plant 1 height / cm	Plant 2 height / cm	Plant 3 height / cm	Mean plant height / cm
0	0.0	0.0	0.0	0.0
1	0.0	0.1	0.0	0.0
2	0.6	0.1	0.3	0.3
3	1.5	0.5	1.2	1.1
4	2.9	1.6	2.5	2.3
5	4.4	2.8		
6	6.8	5.1		
7	8.1	8.3		

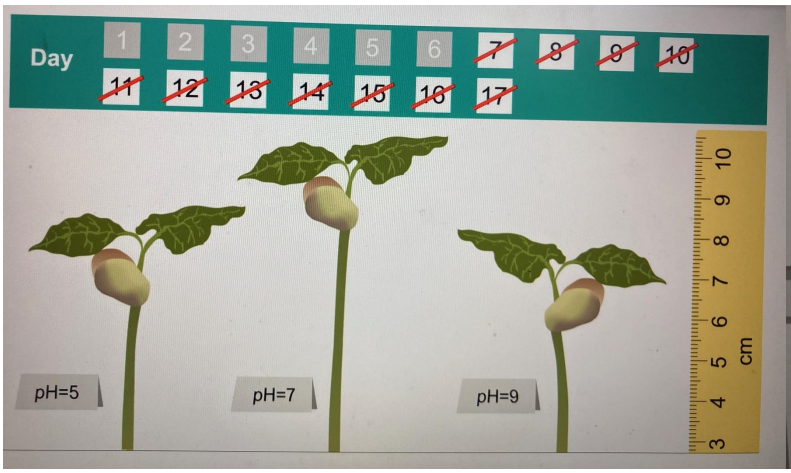
Reset

Calculate the missing mean values to complete the table. Show your working in the box below and add your final values to the table.

Question 4b (1 mark)

An MYP year 5 student is carrying out an investigation to see how the pH of the soil affects the growth of mung bean sprouts. The mung bean sprouts germinated one week before the investigation started. This experiment was performed once for each pH value and was done over 10 days. The bean sprouts were watered regularly.

Mung bean sprouts can grow in a range of conditions as shown in the animation below.



Select the correct description for the pH of each soil type.

pH=5	pH=7	pH=9
Select	Select	Select

Select
Neutral
Acidic
Alkaline

Question 4c (2 marks)

Formulate a research question for the investigation shown in the animation above.

Question 4d (4 marks)

Identify the independent variable, dependent variable and two control variables for this investigation.

Independent variable

Styles

Dependent variable

Styles

Control variable 1

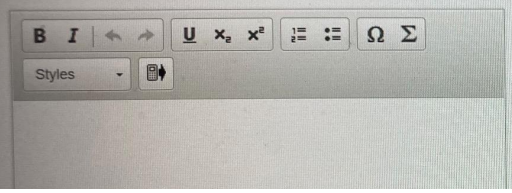
Styles

Control variable 2

Styles

Question 4e (2 marks)

Suggest why it is important to have control variables in a scientific investigation.



Question 4f (1 mark)

The table below shows the data collected by the student. According to the information provided, **state** which pH allowed the best growth of mung bean sprouts.

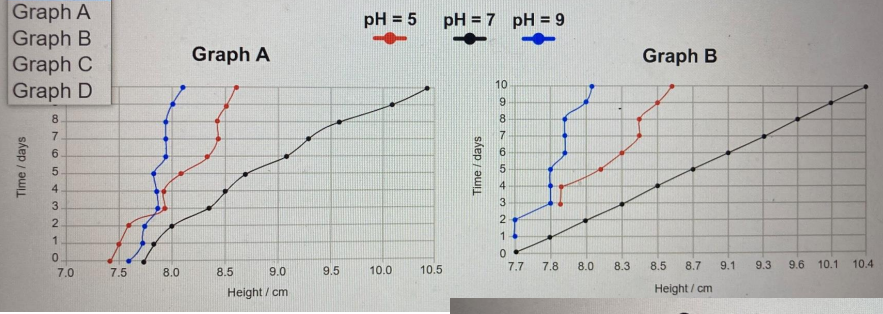
Days	Plant height / cm		
	pH=5	pH=7	pH=9
0	7.4	7.7	7.6
1	7.5	7.8	7.7
2	7.6	8.0	7.7
3	7.9	8.3	7.8
4	7.9	8.5	7.8
5	8.1	8.7	7.8
6	8.3	9.1	7.9
7	8.4	9.3	7.9
8	8.4	9.6	7.9
9	8.5	10.1	8.0
10	8.6	10.4	8.1

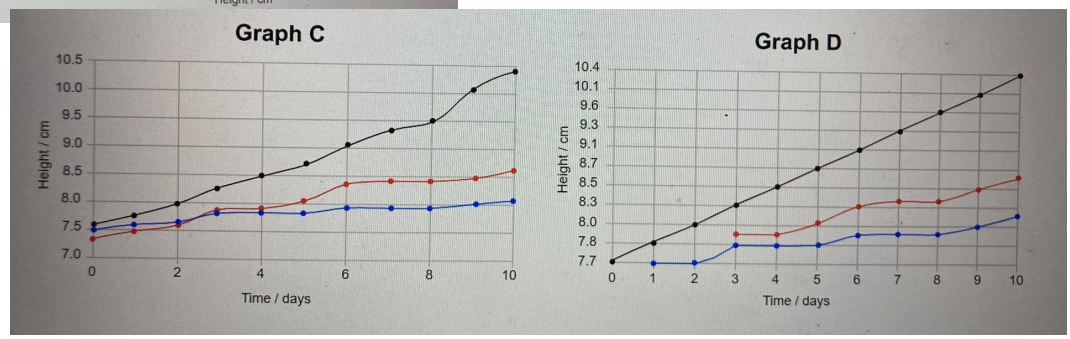
Question 4g (1 mark)

The data from the table is presented in four graphs below.

Select the correct graph to present the data.

Select
Select
Graph A
Graph B
Graph C
Graph D





Question 5 (9 marks)

In recent years, organic farming and gardening techniques have become widely used because they allow plants to grow while keeping the environment free of synthetic pesticides and fertilizers.

Another MYP year 5 student performed an investigation to compare the growth of mung bean sprouts in three types of soil. This student hypothesized:

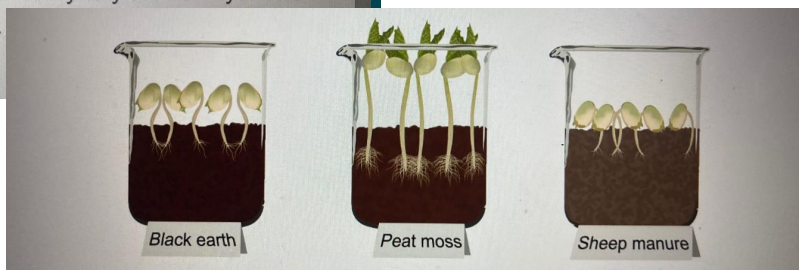
> If there are more nutrients in the soil, then the plant will grow faster because the plant will absorb more nutrients in a shorter time.

The student used the following types of soils:

- Black earth: rich in broken-down plant material which is good at holding water and has low nutrient levels.
- Peat moss: living organic material which is very good at holding water, has low nutrient levels and is slightly acidic.
- Sheep manure: organic material which is rich in nutrients and is highly acidic.

Five seeds were planted in each pot and were given 10 cm^3 of water every day for 10 days. The height of the plants was measured from the soil to the highest point.

The picture below shows the investigation on day five.



Question 5a (4 marks)

Discuss the validity of the student's method in this investigation.

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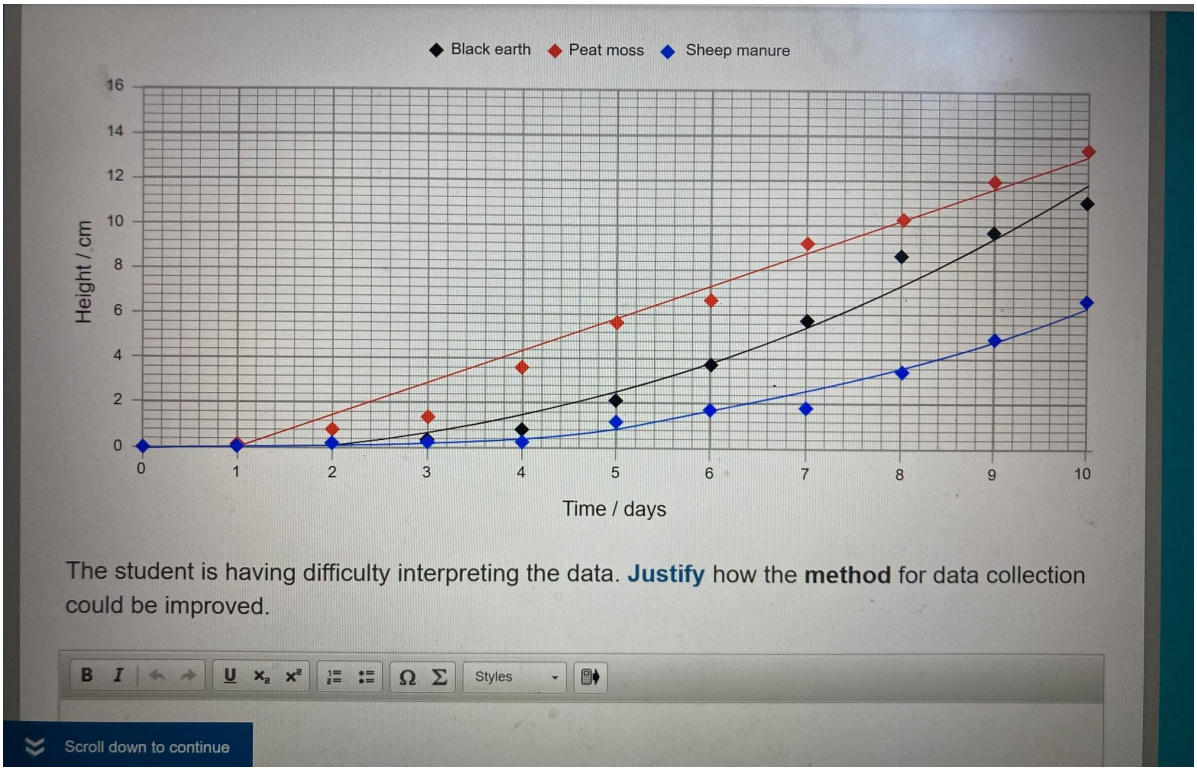
Question 5b (1 mark)

The student's results are shown in the table below.

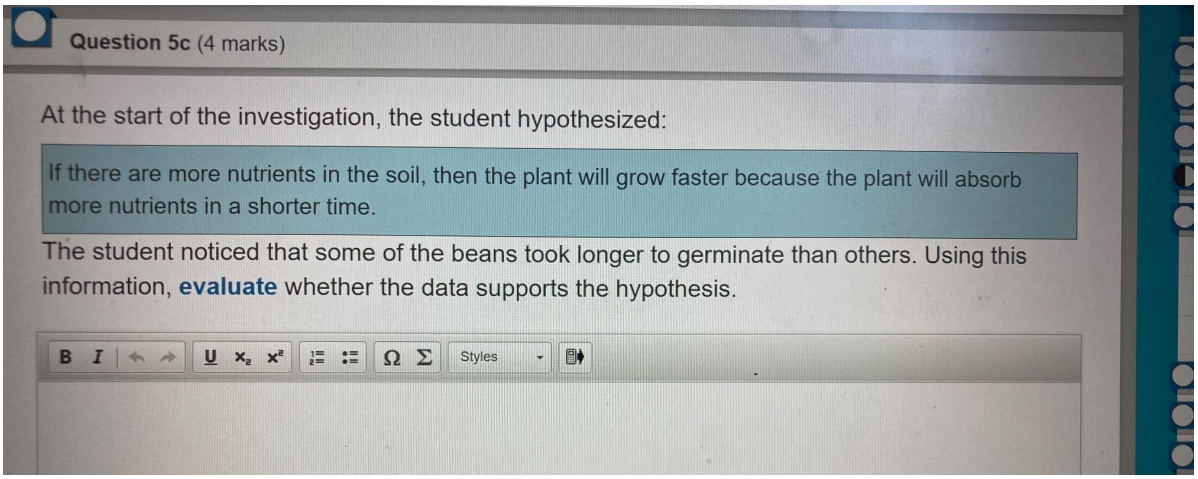
Time / days	Mean height of sprouts		
	Black earth / cm	Peat moss / cm	Sheep manure / cm
1	0.1	0.2	0.1
2	0.2	0.8	0.2
3	0.3	1.3	0.2
4	0.8	3.6	0.2
5	2.2	5.6	1.3
6	3.8	6.7	1.7
7	5.8	9.2	1.9
8	8.7	10.3	3.4
9	9.8	11.9	4.9
10	11.1	13.4	6.7



The student is having difficulty interpreting the data. **Justify** how the **method** for data collection could be improved.

B I U Styles

Scroll down to continue

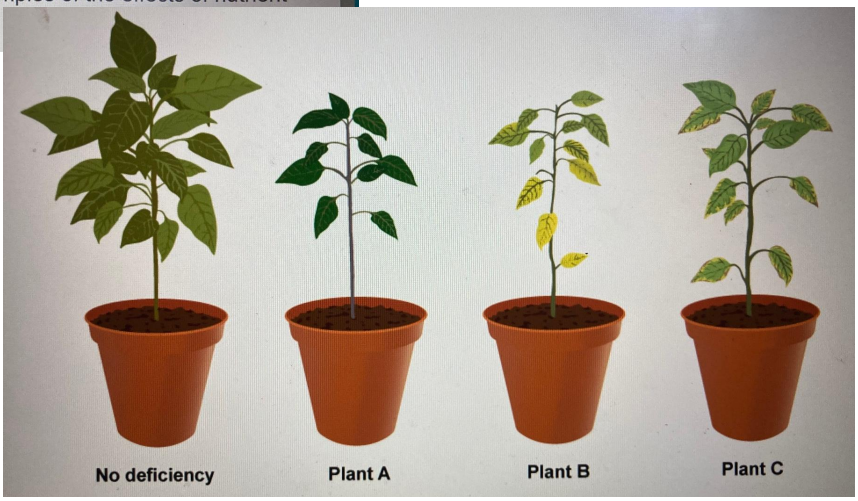

Question 5c (4 marks)
At the start of the investigation, the student hypothesized:
If there are more nutrients in the soil, then the plant will grow faster because the plant will absorb more nutrients in a shorter time.
The student noticed that some of the beans took longer to germinate than others. Using this information, evaluate whether the data supports the hypothesis.
Styles

Question 6 (7 marks)

Fertilizers are used to improve plant nutrition. When the nutrients are balanced the plants look healthier and grow more quickly. Common nutrients used by plants are nitrogen (N), phosphorus (P) and potassium (K) compounds, and the symbols of these elements are used to describe the main nutrients they contain. NPK fertilizer contains nitrogen, phosphorus and potassium.

Question 6a (1 mark)

If a plant does not receive enough of one of the nutrients, it will not grow effectively. This is known as a nutrient deficiency. The images below give some examples of the effects of nutrient deficiency on plants.



Nitrogen deficiency	Phosphorus deficiency	Potassium deficiency
• Yellowing of older leaves • Growth slows down • Leaves drop off	• Darker, dull green leaves • Purple stems • Smaller plant	• Younger leaves are yellow at the tips and edges • Dead or yellow patches develop at the centre of the leaves

Identify which deficiency each plant is suffering from.

Plant A

Select
Select
Nitrogen
Phosphorus
Potassium

Plant B

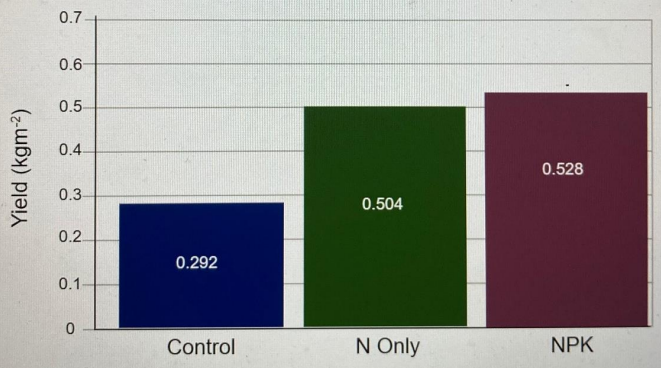
Select

Plant C

Select

Question 6b (2 marks)

A farmer uses fertilizers to improve his wheat crop. The results below show an experiment in which different fertilizers were applied. Fertilizers are expensive and mixed fertilizers are more expensive than single fertilizers. The graph below shows the yield of crop produced when a farmer used the same mass of two different fertilizers on different fields of the same size.



Outline what the graph above indicates.

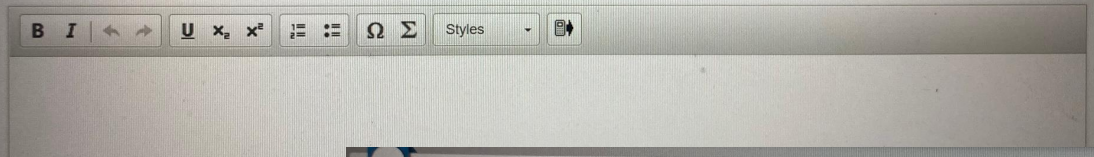
Question 6c (3 marks)

The area of a field is 11 000m^2. N fertilizer costs US$0.170 per kg and NPK fertilizer costs US$0.335 per kg. 100 kg of fertilizer is needed for a 11 000 m^2 field.

The cost of the wheat seeds and water for the field is US$100.

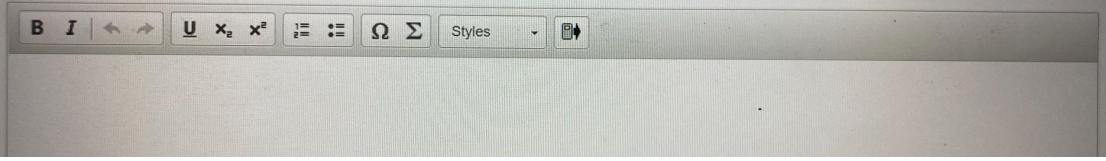
Wheat can be sold for US$0.186 per kg.

If he used N fertilizer on the field, the farmer would make US$914 profit.
Use the graph in part (b) to **calculate** the profit that the farmer would make if he used NPK fertilizer on the field.



Question 6d (1 mark)

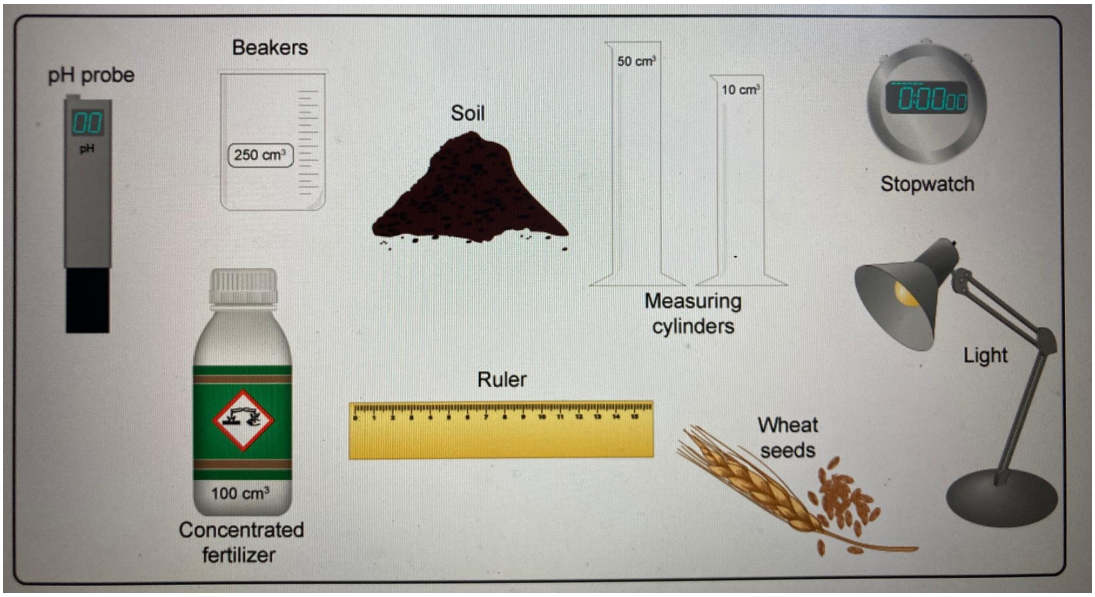
Most farms have many fields. Based on the result of your calculation in part (c), **suggest** which fertilizer the farmer should use. **Justify** your answer.

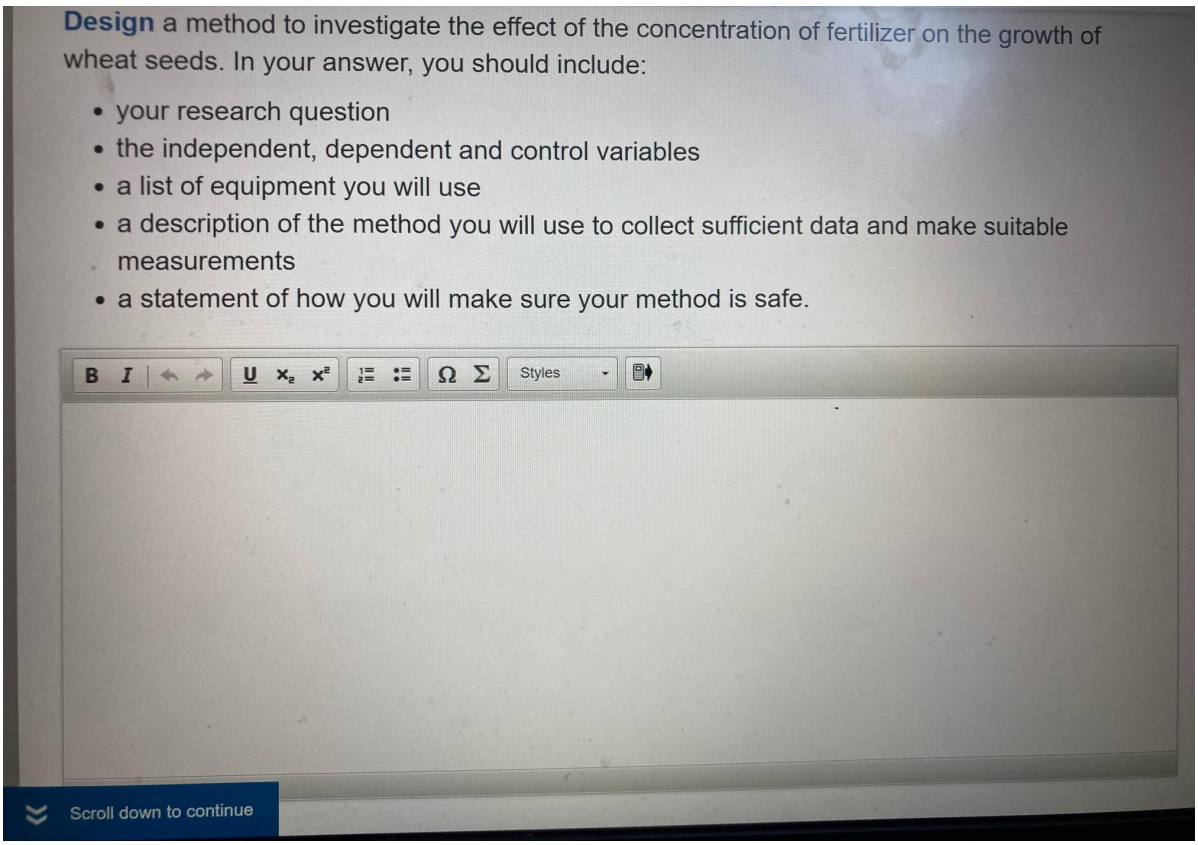


Question 7 (18 marks)

One of the most important nutrients required for plant growth is nitrogen. Nitrogen fertilizers can be added to the soil to increase plant growth. In this question, you will plan an investigation to study the effect of fertilizers. Nitrogen fertilizers are often supplied as a concentrated solution which needs to be diluted before use.

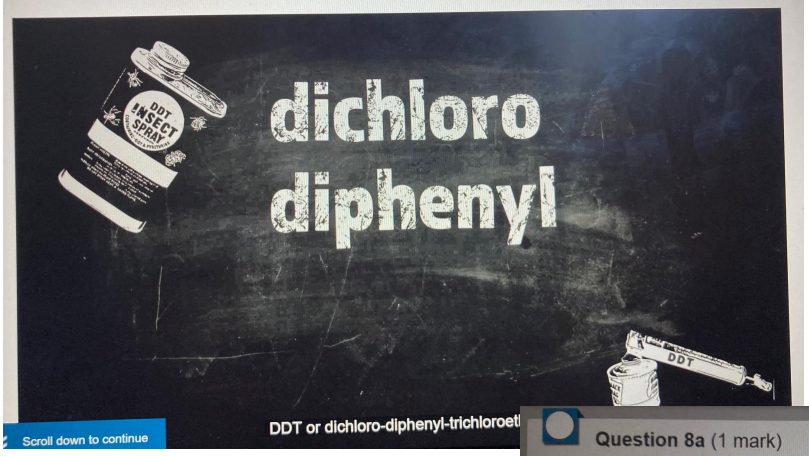
In addition to standard laboratory equipment you are provided with the following:




Design a method to investigate the effect of the concentration of fertilizer on the growth of wheat seeds. In your answer, you should include:
your research question
the independent, dependent and control variables
a list of equipment you will use
a description of the method you will use to collect sufficient data and make suitable measurements
a statement of how you will make sure your method is safe.
Styles
Scroll down to continue

Video Transcript

Throughout history, people have tried to reduce the population size of insects that destroy crops and spread disease. Pesticides are chemicals that are used to kill insects and other pests. One example of a pesticide is DDT (dichloro-diphenyl-trichloroethane).



Question 8a (1 mark)

Pesticides are often used to kill insects. **Suggest** one other method which farmers may use.

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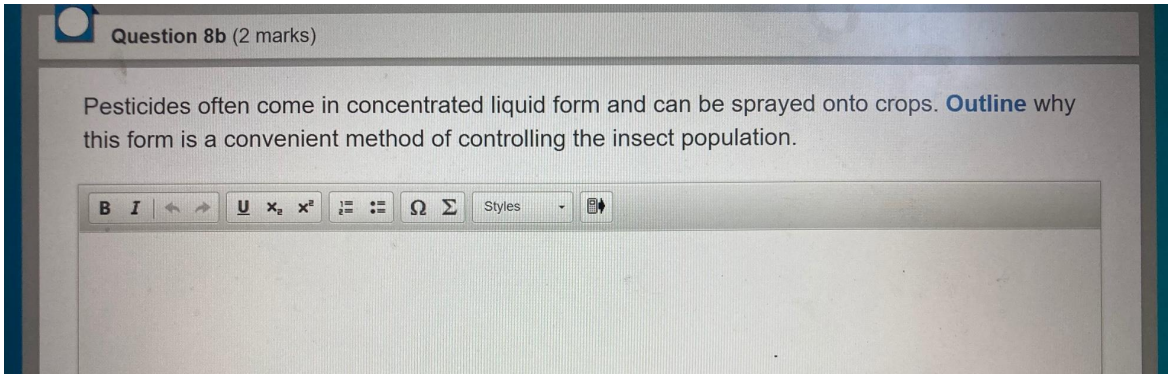
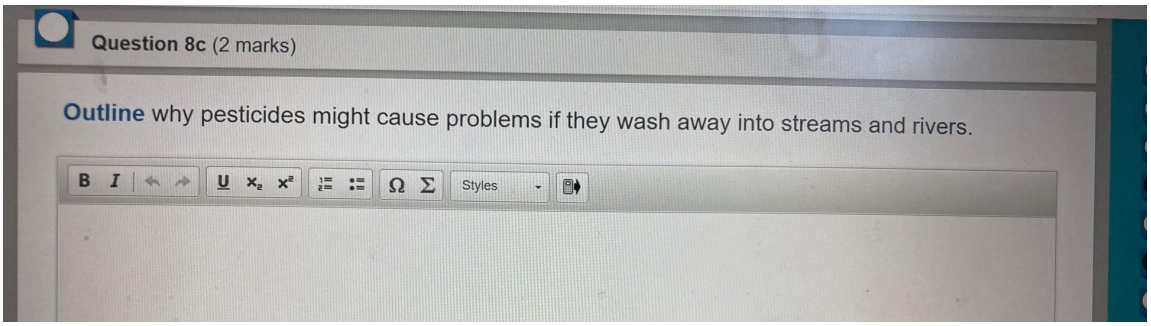
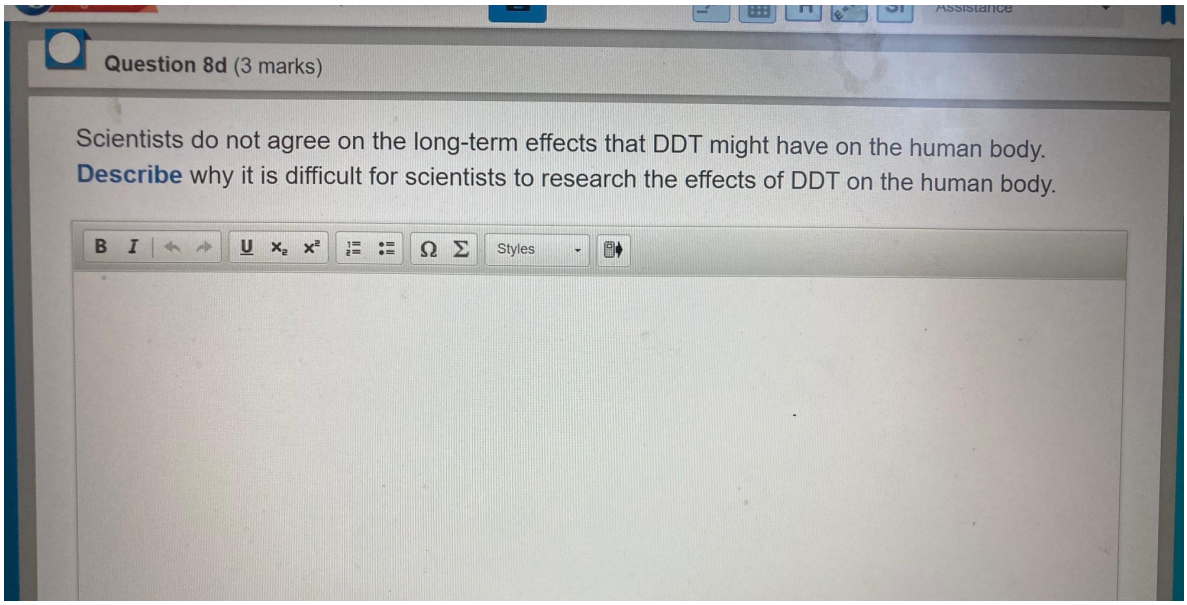

Question 8b (2 marks)
Pesticides often come in concentrated liquid form and can be sprayed onto crops. Outline why this form is a convenient method of controlling the insect population.
Styles


Question 8c (2 marks)
Outline why pesticides might cause problems if they wash away into streams and rivers.
Styles

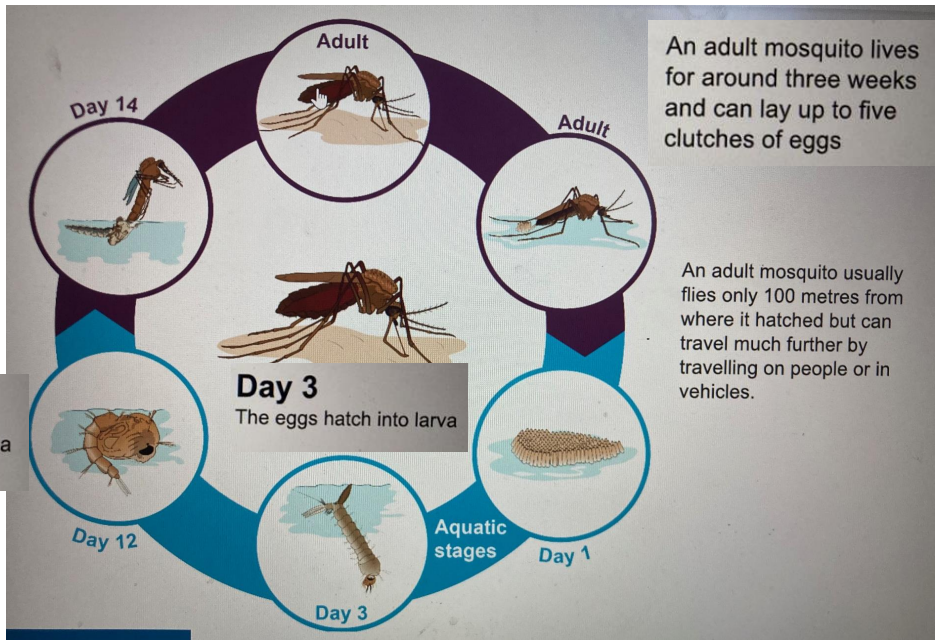

Assistance
Question 8d (3 marks)
Scientists do not agree on the long-term effects that DDT might have on the human body.
Describe why it is difficult for scientists to research the effects of DDT on the human body.
Styles

Question 9 (18 marks)

The Zika virus is spread by the bite of an infected mosquito. It has little effect on adults and children but has major effects on unborn babies. If a pregnant woman is infected, the brain of the unborn baby does not develop properly.

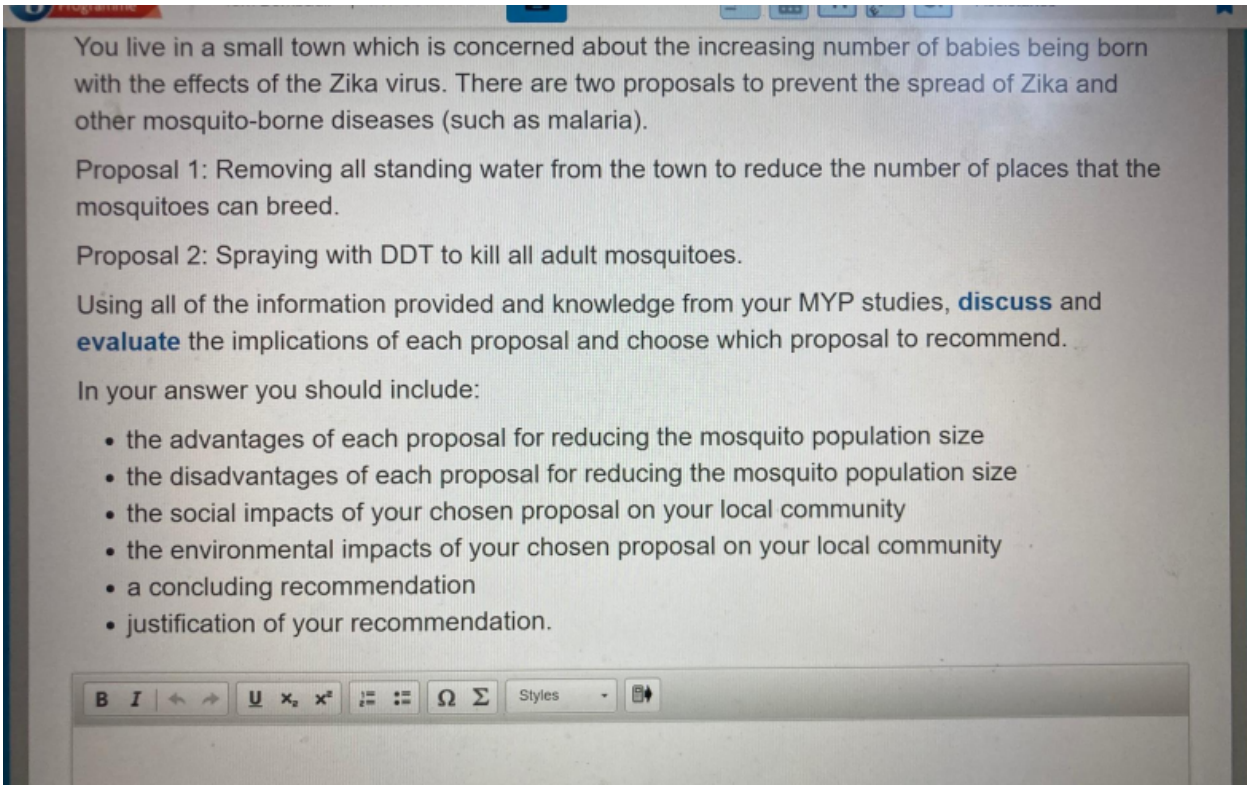
Day 14
The pupa develops into an adult mosquito

Day 12
The larva develops into a pupa



An adult mosquito lives for around three weeks and can lay up to five clutches of eggs

An adult mosquito usually flies only 100 metres from where it hatched but can travel much further by travelling on people or in vehicles.


You live in a small town which is concerned about the increasing number of babies being born with the effects of the Zika virus. There are two proposals to prevent the spread of Zika and other mosquito-borne diseases (such as malaria).

Proposal 1: Removing all standing water from the town to reduce the number of places that the mosquitoes can breed.

Proposal 2: Spraying with DDT to kill all adult mosquitoes.

Using all of the information provided and knowledge from your MYP studies, **discuss** and **evaluate** the implications of each proposal and choose which proposal to recommend.

In your answer you should include:

- the advantages of each proposal for reducing the mosquito population size
- the disadvantages of each proposal for reducing the mosquito population size
- the social impacts of your chosen proposal on your local community
- the environmental impacts of your chosen proposal on your local community
- a concluding recommendation
- justification of your recommendation.

B I U x_2 x^2 Ω Σ Styles