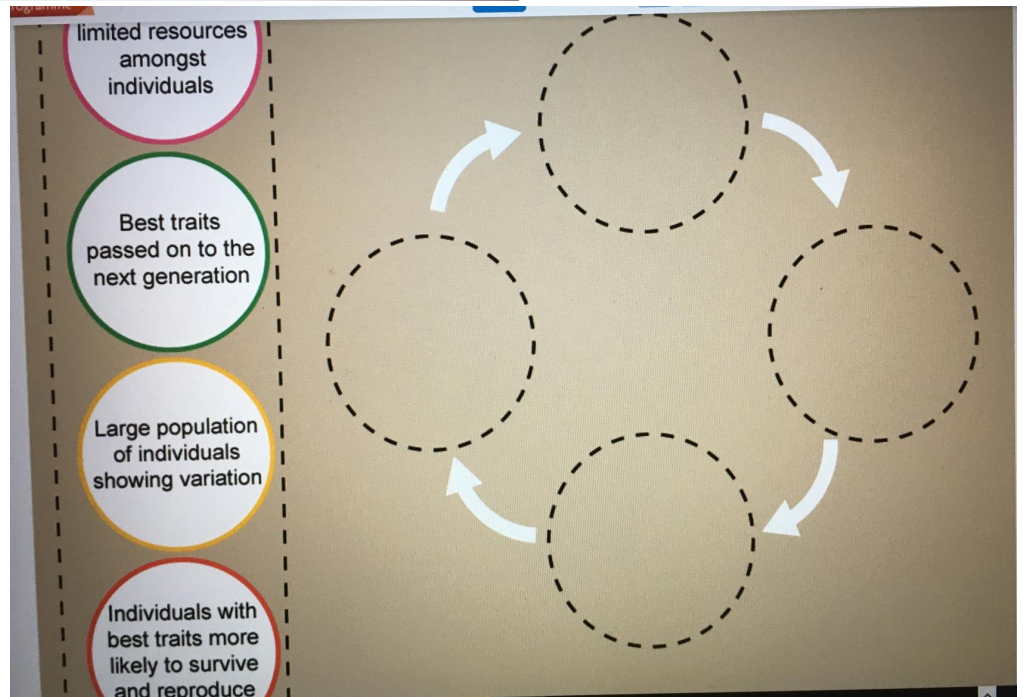


**MYP e-assessment
Integrated Science
November 17**

Question 1a (2 marks)

Charles Darwin and Alfred Wallace developed the theory of natural selection which describes how evolution occurs.

Organize the phrases in the correct sequence to describe the process of natural selection.



Parasite

Predator

Producer

Draggable items:

- An organism that lives in or on another organism and benefits at the host's expense
- An animal that eats plants only and not other animals
- An animal that kills and eats other animals
- An organism that converts inorganic substances into organic ones
- An animal that is eaten by other animals



Question 1c (4 marks)

An *adaptation* is a feature that has evolved within a population of organisms that makes the population better suited to the environment in which it lives.

Camels are organisms that have several adaptations that allow them to live in sandy deserts.

This media is interactive

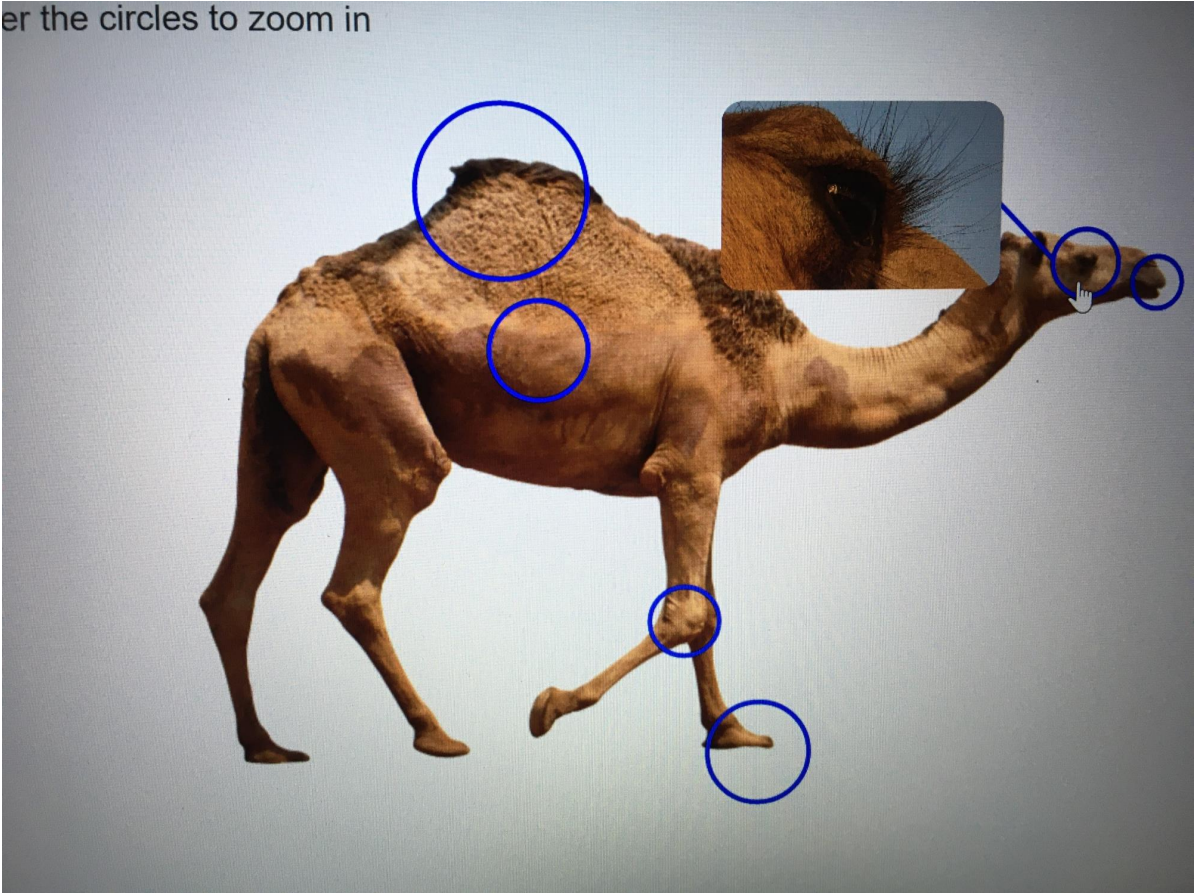
Hover over the circles to zoom in



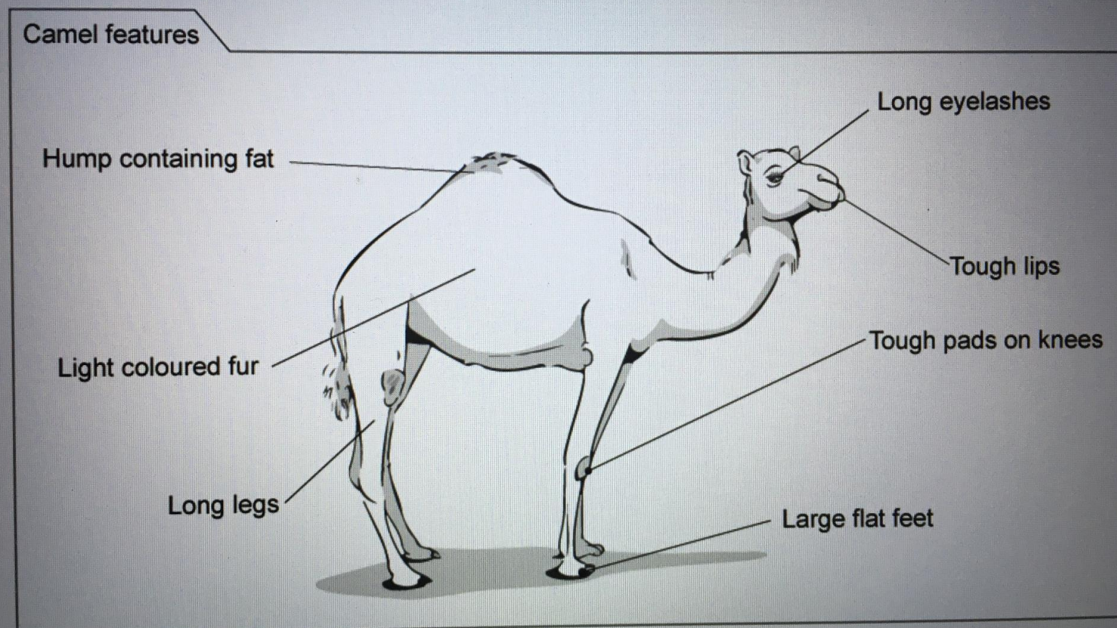
Type here to search



er the circles to zoom in



Choose **four** adaptations from the image below and **state** why each adaptation helps the camel survive the sandy ecosystem.





Question 1d (3 marks)

Video

[Transcript of the video](#)

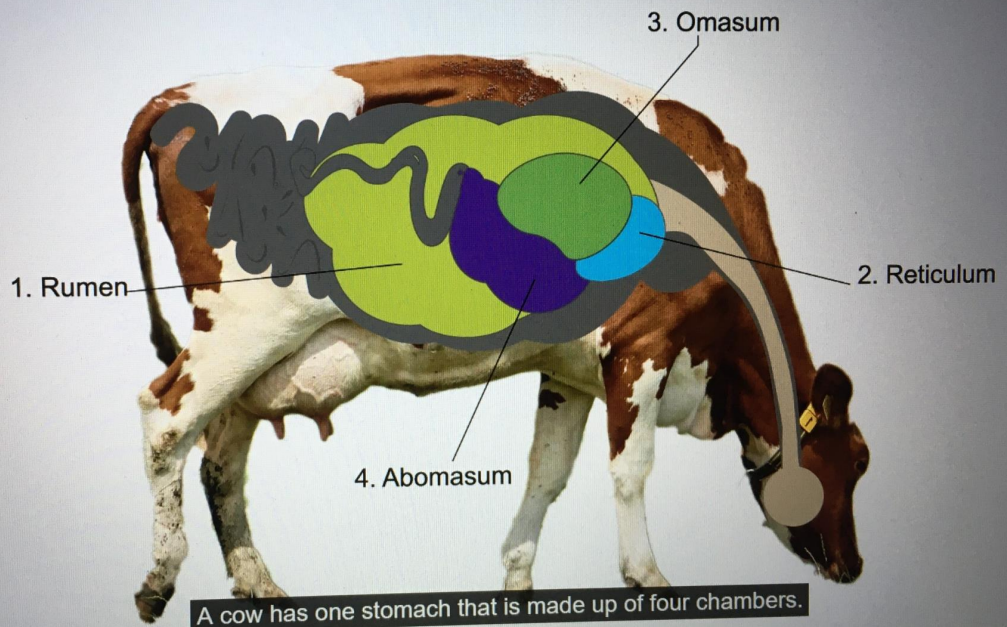
The discovery of fire allowed early humans to cook food. Cooking makes food easier to digest and absorb into the bloodstream. Humans evolved a narrow waist and shortened digestive tract because they were able to cook food.

Cows have adapted to their available food source in a different way. Cows evolved a process called rumination to digest plant fibres.

The following animation explains how a cow's digestive system works.

Diagram not to scale

Diagram not to scale



Video Transcript of the video Assistance

A cow has one stomach that is made up of four chambers.

The first three chambers are full of microbes that digest plant material.

The last chamber is called the abomasum. The abomasum contains acids and enzymes as in a human stomach.

When the cow goes out to feed, it eats grass as quickly as possible and swallows it almost unchanged.

Food that goes into the first chamber of the stomach, the rumen, is difficult to digest.

The microbes cannot enter the plant fibre to start the chemical process of digestion.

The cow has evolved the process of rumination to break down plant fibres.

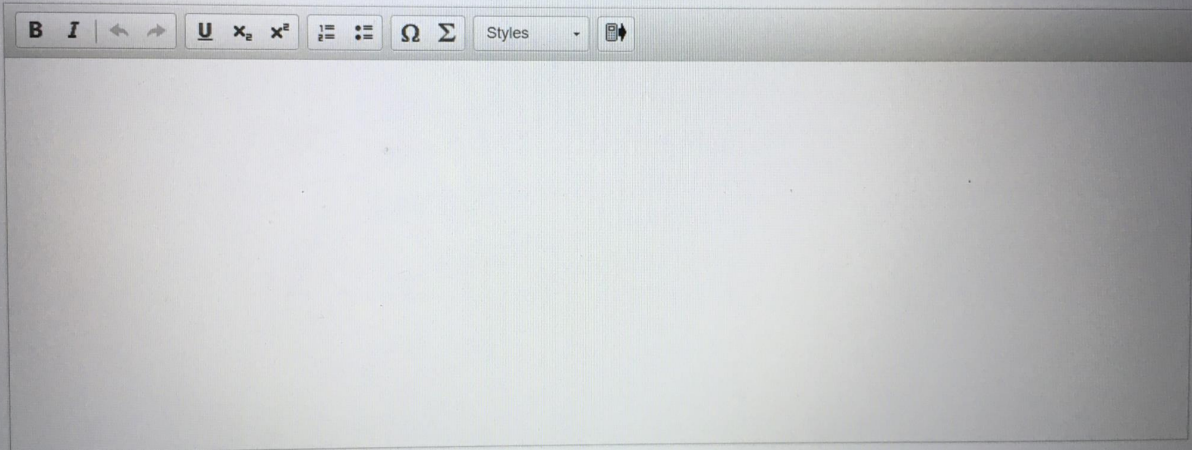
After swallowing, the food moves around the first three chambers and mixes with the microbes that live there. Microbes secrete enzymes into the food.

The food is brought back up to the mouth and the cow gives it a good chew. This mixes the food with the enzymes so that the process of chemical digestion can take place.

The food is then re-swallowed, coming back down into the rumen.

The food then moves to the abomasum where the process of digestion is completed.

Compare and contrast the features shown in the animation of the cow's digestive system with the human digestive system.



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 Save icon (floppy disk).

Question 2 (8 marks)

Question 2a (2 marks)

Humans use enzymes within the digestive system to break up their food to obtain the necessary nutrients.

State two functions of enzymes.

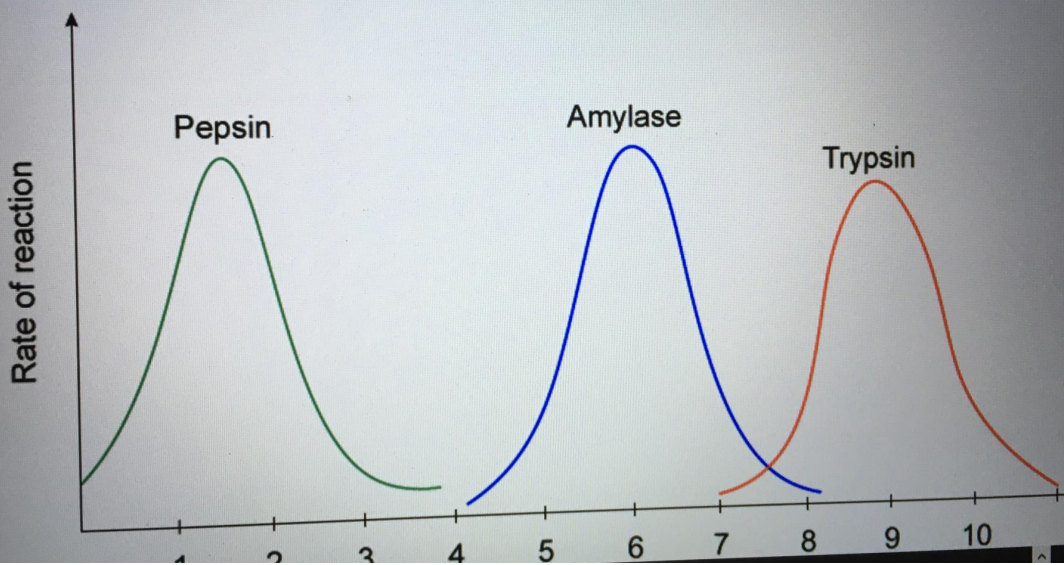
Function 1

B I **U** \times_2 \times^2 Ω Σ Styles

Function 2

Question 2b (3 marks)

Enzymes work at a specific pH known as the *optimum* pH. The graphs below show the optimum pH for different enzymes found in the human body.



In the human digestive system, digested food is neutralized when it reaches the small intestine. Use the graphs to **determine** which enzyme you would expect to see in the small intestine. **Justify** your answer using scientific reasoning.

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

Question 2c (3 marks)

In the small intestine hydrochloric acid is neutralized with sodium hydrogen carbonate (NaHCO_3). The word equation for this reaction is:

hydrochloric acid + sodium hydrogen carbonate \rightarrow sodium chloride + water + carbon dioxide

Write down a balanced chemical equation for this reaction.

B **I** \leftarrow \rightarrow U \times_2 \times^2 \equiv \equiv Ω Σ Styles

Question 3 (7 marks)

Question 3a (3 marks)

Many types of pain relief tablets you find in the shops are *enteric coated*. This means they are coated with a substance which delays the tablet from dissolving until it has passed through the stomach into the small intestine.

Suggest why it is an advantage for a tablet to dissolve in the small intestine rather than the stomach.

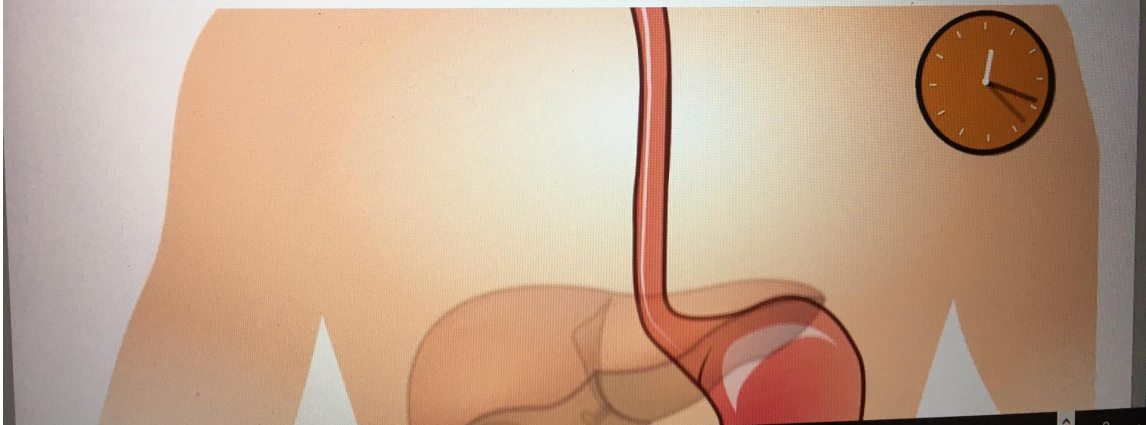
Rich text editor toolbar with icons for Bold (B), Italic (I), Undo, Redo, Underline (U), Text color (x), Background color (x), Bulleted list, Numbered list, Link (Ω), Unlink (Σ), Styles dropdown, and a document icon.

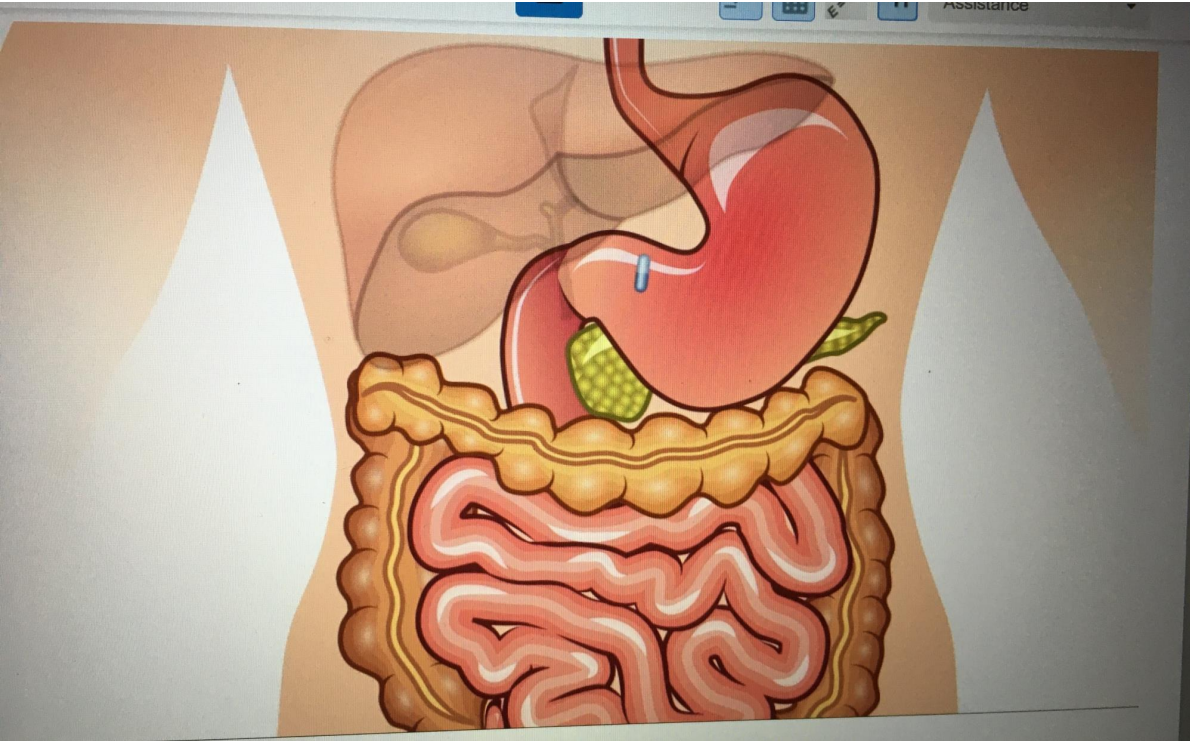
Question 3b (4 marks)

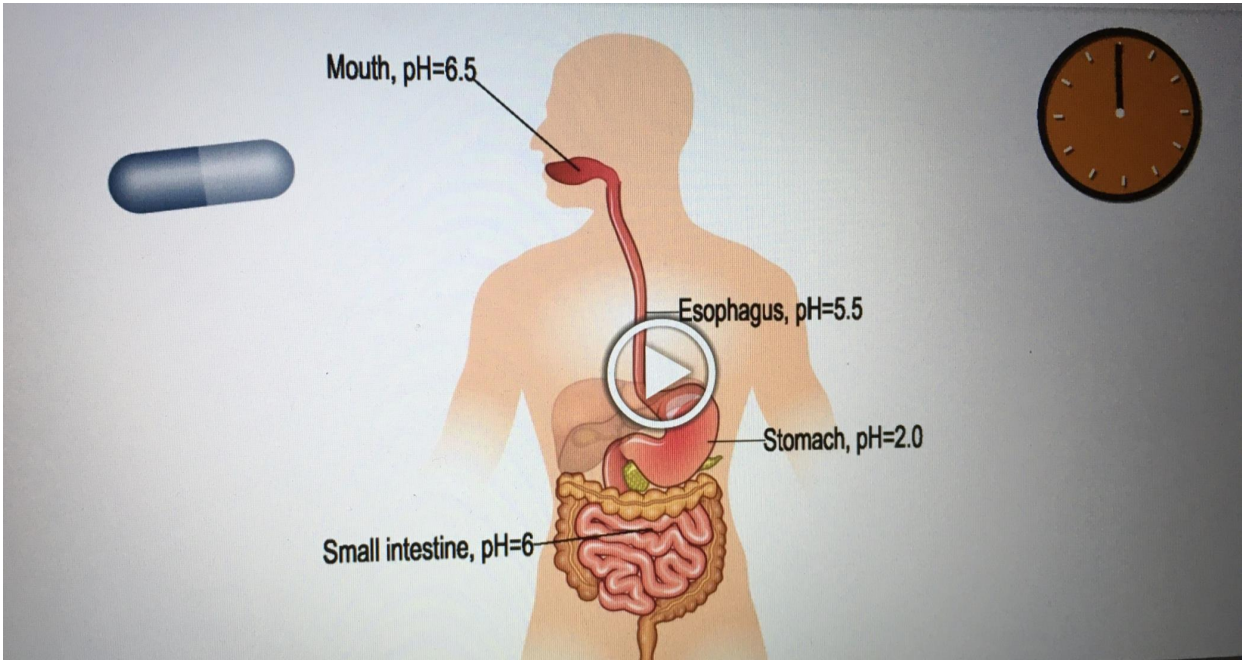
A student is carrying out an investigation to see which type of enteric coating is best for the delivery of a particular medication. This medication needs to dissolve as soon as possible when it reaches the small intestine.

This media contains no audio

Diagram not to scale



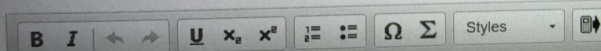




The student has three different types of enteric coating. Inside each coating is a sample of blue dye. The student places these tablets into liquids with different pH and records the time it takes for the liquids to turn blue.

Coating	Time for the liquid to turn blue / h		
	pH 1	pH 4	pH 7
A	8.00	1.50	0.75
B	4.00	3.00	0.25
C	6.00	4.00	0.20

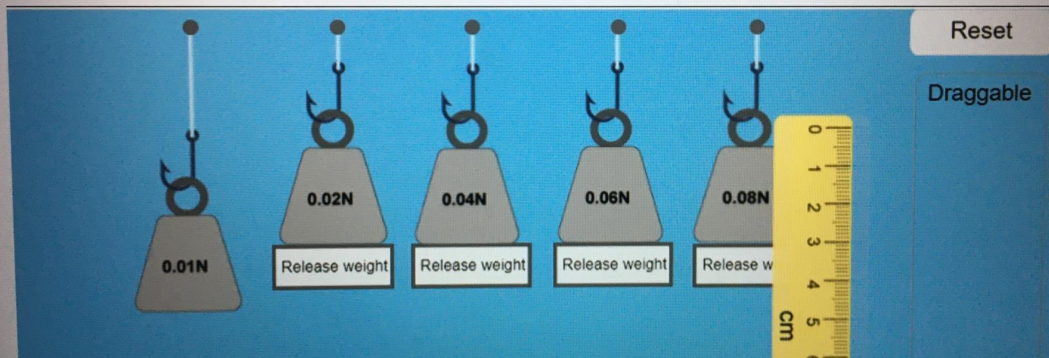
Use the information in the table provided to **state** which coating would be the most suitable for this medication. **Justify** your choice using scientific reasoning.



Question 4 (16 marks)

Many spiders produce silk which they use to spin their webs. Spider silk is very strong. Some students are carrying out an experiment to investigate how the length of a piece of spider silk is related to the force applied to it. The force is varied by using different weights. The unit of force is the newton, symbol N.

This media contains no audio and is not interactive





Question 4a (1 mark)

These are the variables for the investigation.

Independent variable	Force
Dependent variable	Length
Control variable	Position of ruler

Select one other variable that must be controlled.

- Time Temperature of the air Starting length of silk Shape of the weight



Question 4b (4 marks)

Use the simulation to collect appropriate data and **present** your results in the table below.

0.01N
Release weight

0.02N
Release weight

0.04N
Release weight

0.06N
Release weight

0.08N
Release weight

Reset

Draggable

0 1 2 3 4 5 6 7 8 9 10
cm

Type here to search

Force / N	Length of spider silk / cm

Reset





Question 4c (2 marks)

The position of the ruler was a control variable in this investigation

Outline how this variable might affect the results if it was not controlled.

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

Question 4d (2 marks)

A different group of students carried out the same experiment with a different starting length of spider silk. These students carried out three trials of their experiment. **Determine** the mean of the missing results.

Force / N	Length of spider silk / cm			
	Trial 1	Trial 2	Trial 3	Mean
0.00	6.4	6.4	6.4	6.4
0.01	8.2	8.3	8.1	8.2
0.02	8.8	8.7	8.7	8.7
0.03	9.4	9.4	9.5	
0.04	9.9	10.1	10.0	10.0
0.05	10.6	10.5	10.6	

Question 4e (2 marks)

A teacher asks the students to calculate the extension of spider silk using the formula

$$\text{extension} = \text{mean length} - \text{the unstretched length}$$

The table below shows the student's calculated values.

Force / N	Extension of spider silk / cm
0.00	0.0
0.01	1.8
0.02	2.3
0.04	3.6
0.06	4.8
0.08	6.0

Plot a graph of extension against force.

Describe the relationship between extension and force shown in the graph.

Below 0.01N

Rich text editor toolbar for the 'Below 0.01N' section, including buttons for bold (B), italic (I), text color, background color, underline (U), subscript (x₂), superscript (x²), bulleted list, numbered list, link (Ω), and unlink (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'Copy' icon.

Above 0.01N

Rich text editor toolbar for the 'Above 0.01N' section, including buttons for bold (B), italic (I), text color, background color, underline (U), subscript (x₂), superscript (x²), bulleted list, numbered list, link (Ω), and unlink (Σ). Below the toolbar is a 'Styles' dropdown menu and a 'Copy' icon.

Question 5 (22 marks)

A student wonders if his guitar strings act like spider silk. He knows that his steel guitar strings have different diameters.



The student wants to know if there is a relationship between diameter of the string and how much force he can hang from the (unwound) string until it breaks.



Question 5a (2 marks)

State the independent variable and the dependent variable in this experiment.

Independent variable

Dependent variable



Question 5b (18 marks)

You are provided with several sets of guitar strings, each with the following diameter.

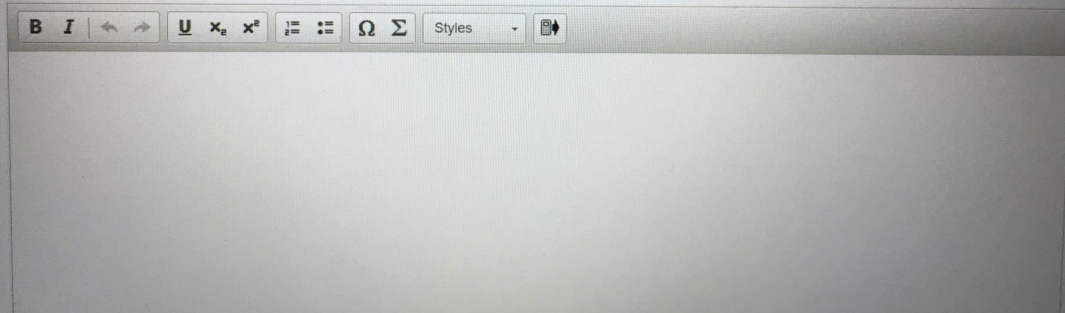
Diameter of string / mm
0.28
0.33
0.46
0.71
0.97
1.22

The following equipment is also available:

- ruler
- clamp stand
- sticky tape
- thermometer
- stop clock
- slotted masses
- hanger
- safety glasses
- foam mat
- thread
- strong glue
- 1N weights

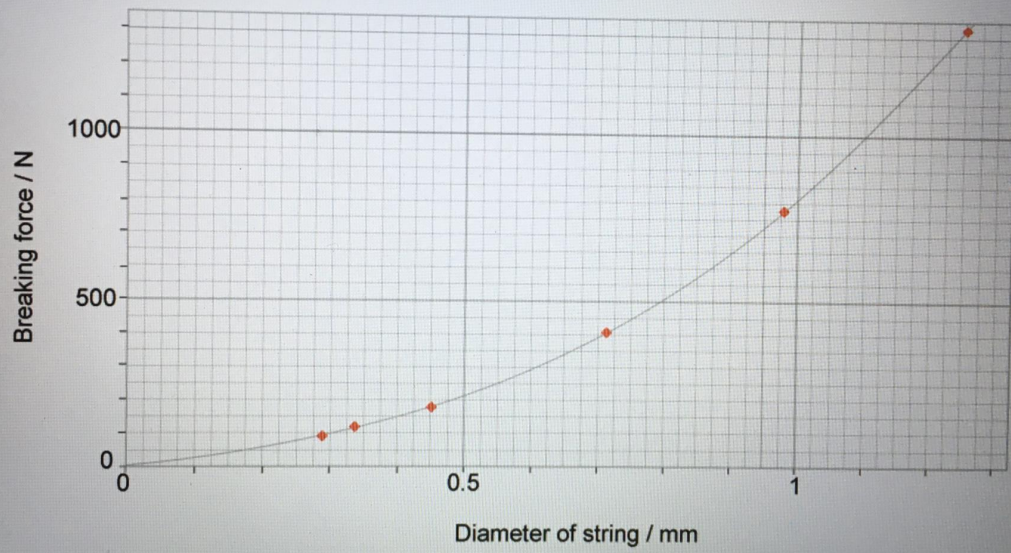
Design a method to investigate how the force needed to break a guitar string is related to the string's diameter. In your answer, you should:

- identify two control variables
- select additional equipment you will use
- describe how you will set up the equipment
- outline how you will collect sufficient data
- outline how to make suitable measurements
- state how you will make sure your method is safe.




Question 5c (2 marks)

The student has plotted the results on the graph below.



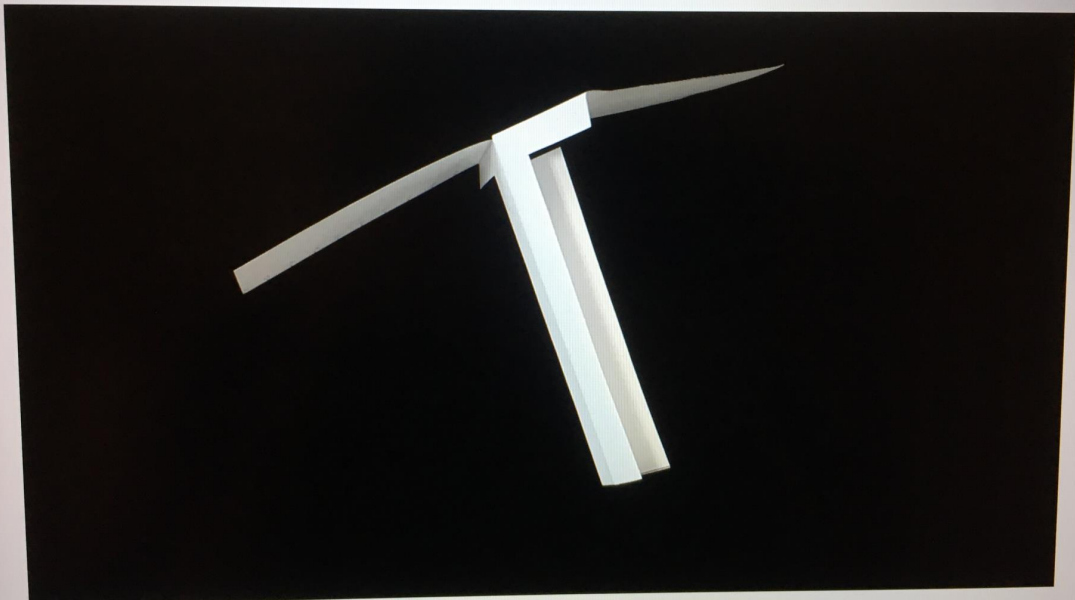
Use the graph to **outline** the relationship between breaking force and diameter of the string.



The image shows 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), Omega symbol (Ω), Sigma symbol (Σ), a dropdown menu labeled "Styles", and a mobile device icon.

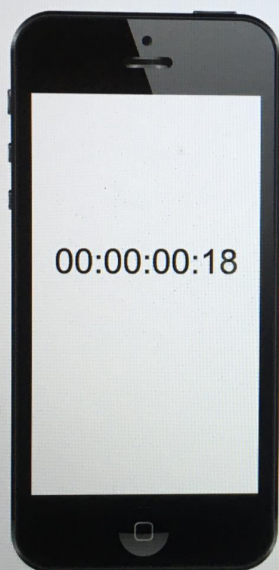
Some students are investigating paper helicopters.

Watch a student carry out the experiment.



Some students are investigating paper helicopters.

Watch a student carry out the experiment.





Question 6b (4 marks)

There are several errors in the method seen in the video. **Identify** two errors in the method and **outline** how these errors will affect the time recorded.

Error 1

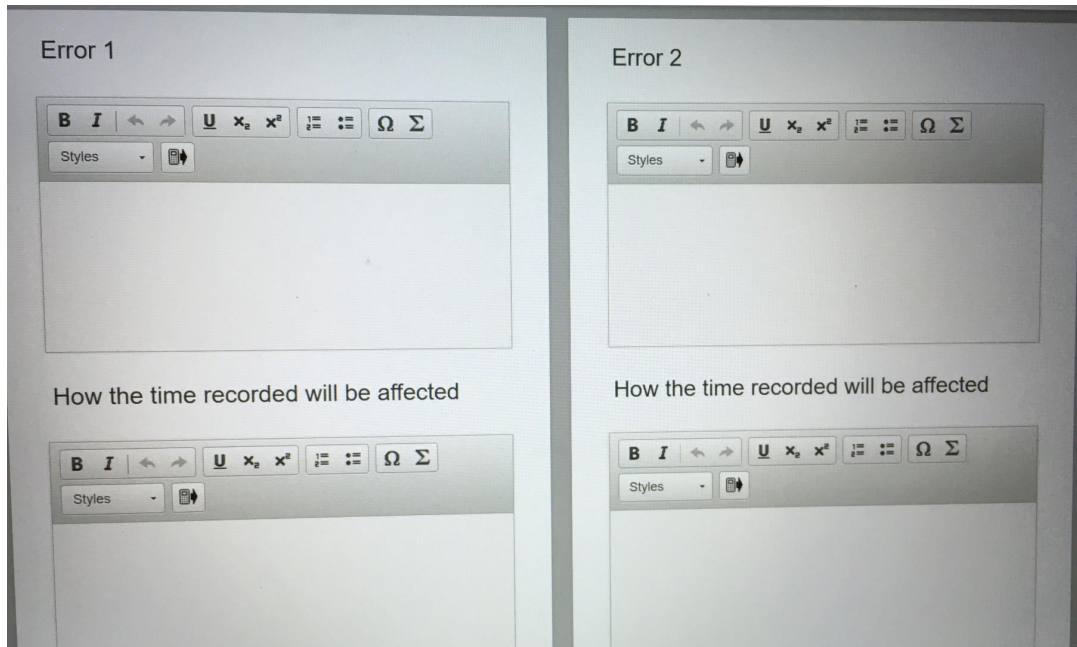
B I ← → x₂ x² ∑ ∫ Ω Σ
Styles ▾ ↕

How the time recorded will be affected

Error 2

B I ← → x₂ x² ∑ ∫ Ω Σ
Styles ▾ ↕

How the time recorded will be affected



Question 6c (1 mark)

Outline how one of the errors from your answer in part (b) could be corrected.

B I **U** x_2 x^2 Ω Σ

Styles



Question 6d (1 mark)

Suggest a different independent variable that could be investigated to extend this investigation.

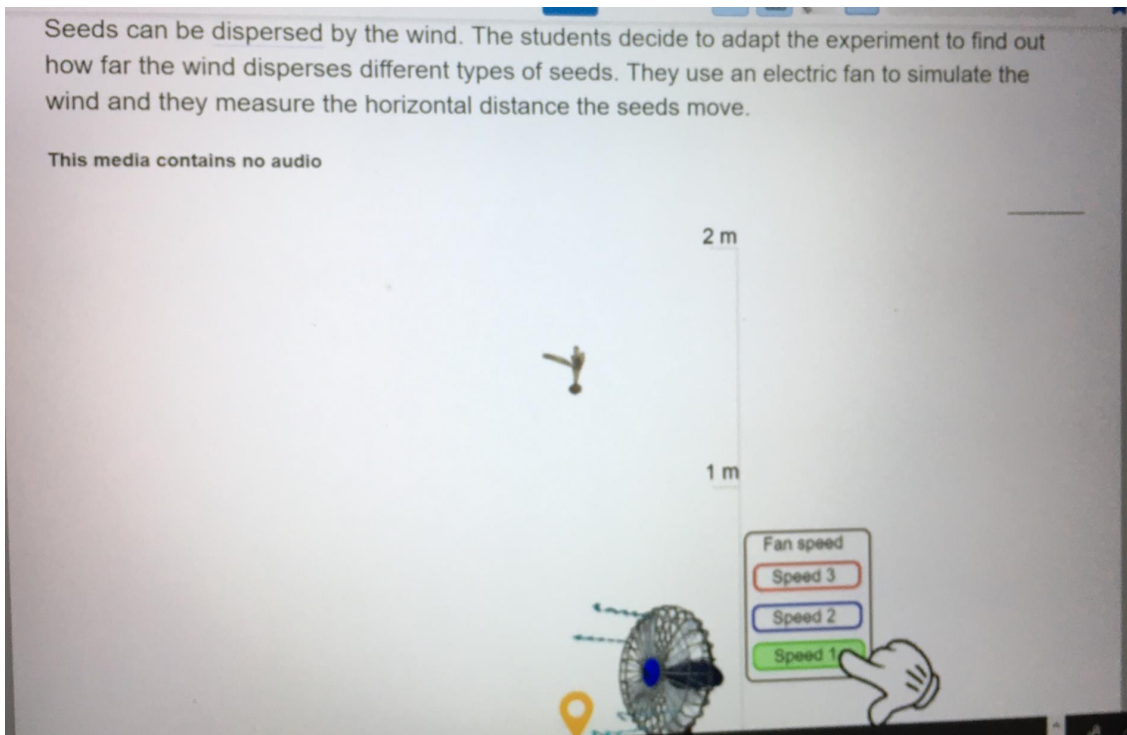
B I **U** x_2 x^2 Ω Σ

Styles



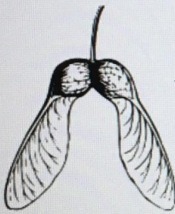
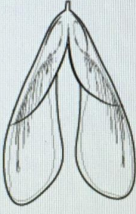

Seeds can be dispersed by the wind. The students decide to adapt the experiment to find out how far the wind disperses different types of seeds. They use an electric fan to simulate the wind and they measure the horizontal distance the seeds move.

This media contains no audio

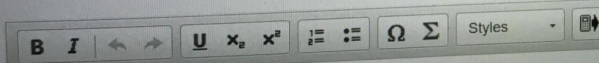




The table below shows the seeds used for this investigation.

Use the concept of air resistance to **select** the seed which you predict will move the greatest horizontal distance when the fan is set on speed 3. **Justify** your answer.

Length of each wing 3 cm	Length of each wing 2 cm	Length of each wing 4 cm
 A	 B	 C

Justification

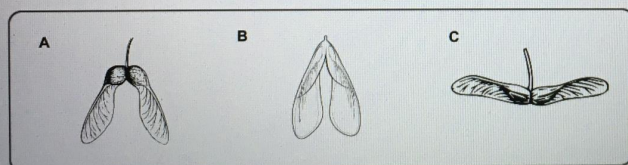


<p>Acer circinatum 8 m tall</p> 	<p>C</p> <p>Length of each wing 4 cm</p> 	<p>Growing in an opening in a dense forest</p>
--	--	--

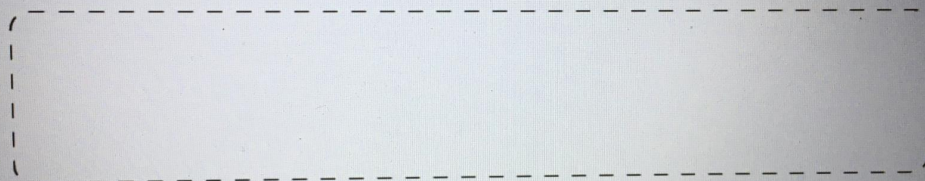
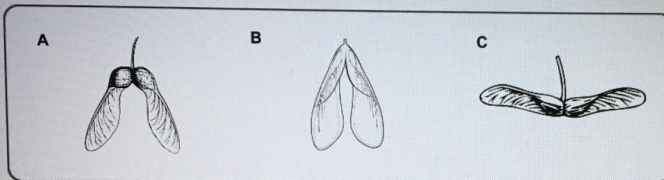
©

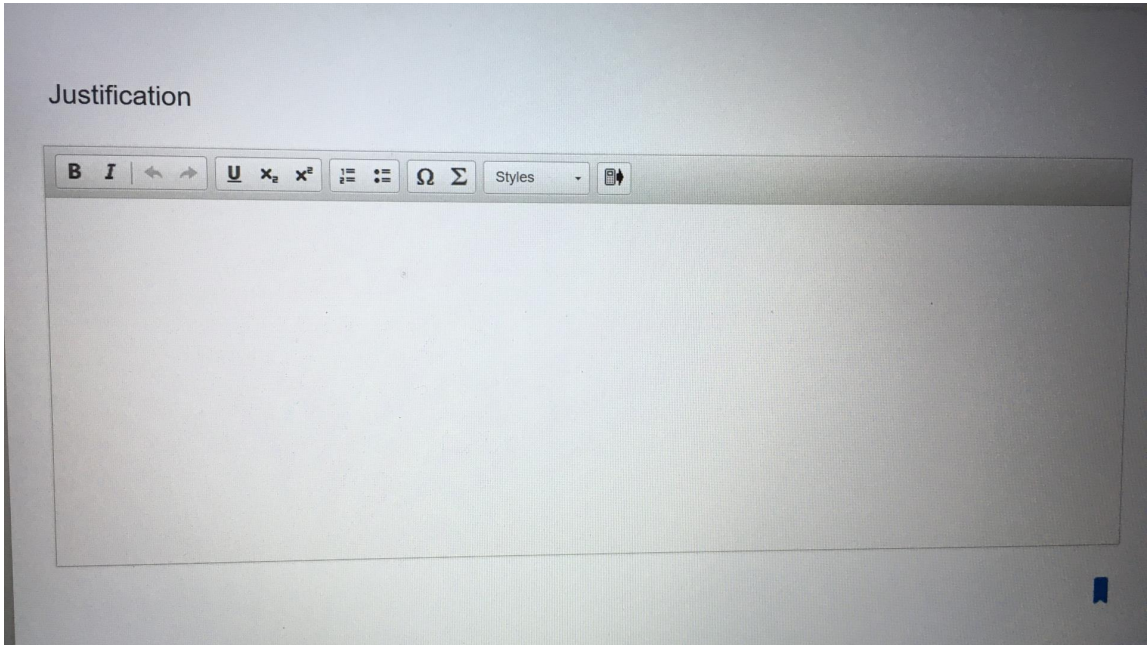
Organize the seeds in order of increasing horizontal distance moved. Use the information in the table to **justify** the order for each seed.

Draggable items



Draggable items







Question 6g (2 marks)

Outline why it might be an advantage for a tree to disperse its seeds over a greater horizontal distance.

B I | ← → | x₂ x² | ¶ ≡ ≡ | Ω Σ | Styles | ↕

Question 7 (8 marks)

According to the United States Institute for Energy Research, 19.5 % of the electricity produced in the United States in 2015 came from nuclear power plants.

Uranium is the fuel most widely used to produce nuclear energy. Uranium has an atomic number of 92. It mainly comprises two *isotopes*, uranium-238 and uranium-235.

Question 7a (2 marks)

Outline the meaning of the term *isotope*.

B **I** ← → **U** x_n x^2 $\frac{a}{b}$ $\frac{a}{b}$ Ω Σ

Styles ▾

Question 7b (1 mark)

Determine the number of neutrons in uranium-235.

B **I** ← → **U** x_n x^2 $\frac{a}{b}$ $\frac{a}{b}$ Ω Σ

Styles ▾

Question 7c (1 mark)

Nuclear energy is released through a nuclear reaction by fission or fusion of atomic nuclei.

State what happens in the process of nuclear fission.

Question 7d (4 marks)

The nuclear industry is highly regulated to minimize the risk of exposure to ionising radiation.

Suggest an effect of radiation exposure on each of the following:

The nuclear industry is highly regulated to minimize the risk of exposure to ionising radiation.
Suggest an effect of radiation exposure on each of the following:

Human health

B I ← → x₂ x² $\frac{1}{z} = \frac{1}{z}$ $\Omega \Sigma$
Styles ▾

Farming

B I ← → x₂ x² $\frac{1}{z} = \frac{1}{z}$ $\Omega \Sigma$
Styles ▾

Environment

B I ← → x₂ x² $\frac{1}{z} = \frac{1}{z}$ $\Omega \Sigma$
Styles ▾

Population

B I ← → x₂ x² $\frac{1}{z} = \frac{1}{z}$ $\Omega \Sigma$
Styles ▾

Question 8 (10 marks)

Nuclear power is obtained from the process of nuclear fission. In a boiling water reactor, the heat produced during a nuclear chain reaction is used to boil water to produce steam which then turns a turbine. This system produces huge amounts of energy in the form of electricity. However, the use of nuclear power to generate electricity is a controversial subject.

Question 8a (4 marks)

Suggest two concerns about using the **process** of generating electricity using nuclear power. **Justify** your answers.

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

Three major accidents at nuclear power plants that have occurred in recent times were at Three Mile Island in the United States, Chernobyl in Ukraine, and Fukushima in Japan.

Timeline of major accidents at nuclear power plants

Three Mile Island (USA) 1979



What happened

Partial meltdown of reactor after a valve stuck. Radioactive gases were released into the atmosphere.

International nuclear event scale - 5

Accident with wider consequences.

Consequences

No injuries or detectable health impacts from the accident, beyond the initial stress.

Chernobyl (Ukraine) 1986



What happened

Operator errors caused uncontrolled reactor conditions. A steam explosion caused an open-air graphite fire. Radioactive material was spread over large parts of the western Soviet Union and Europe.

International nuclear event scale - 7

Major accident.

Consequences

Health impact increased cancer rate impact on the environment.

Fukushima (Japan) 2011



What happened

The nuclear power plant was damaged as a result of an earthquake and tsunami. Radioactive material leaked into sea water and was spread around the world.

International nuclear event scale - 7

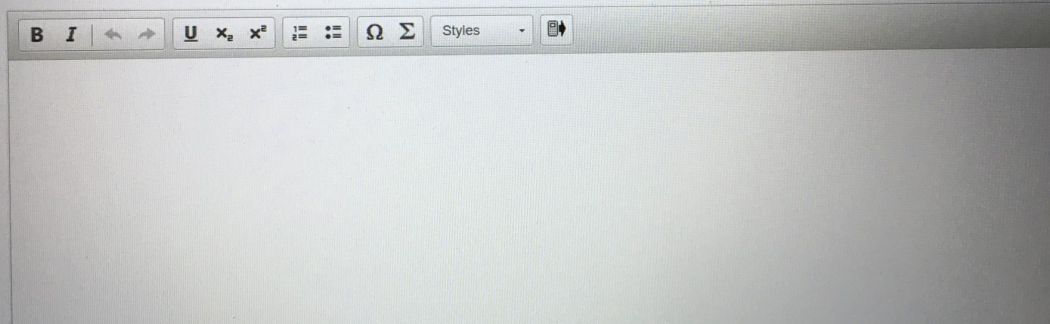
Major accident.

Consequences

No deaths from short-term radiation exposure. Authorities are still monitoring.

Suggest the responsibility of different governments, institutions or companies to minimize the consequence of disasters like Three Mile Island, Fukushima or Chernobyl. In your answer, you should include:

- details of systems that should be built into nuclear power plants to reduce the harmful effects of possible nuclear incidents
- what should be the immediate response after an incident
- how governments and other institutions can plan for long term recovery after an incident.



Energy source	Death rate / per 10 ⁹ kWh	Start-up cost / \$kW ⁻¹	Start-up cost and running cost per kilowatt hour / \$(kWh) ⁻¹	Mass of carbon dioxide equivalent produced per kilowatt hour / gCO ₂ (kWh) ⁻¹
Coal	98	3800	35	1010
Biofuel/ biomass	26	31300	87	22
Natural gas	5	900	49	465
Hydro	1.8	3000	55	5
Solar	0.42	4200	121	49
Wind	0.13	2300	67	12
Nuclear	0.042	2300	77	17

Using the information provided and knowledge from your wider MYP integrated sciences studies, **discuss** and **evaluate** whether governments should recommend that all new power plants should use nuclear energy. In your answer, you should consider:

- advantages of using nuclear power compared to other energy sources
- disadvantages of using nuclear power compared to other energy sources
- environmental considerations
- economic considerations
- a scientific justification of your opinion on whether all new power plants should be nuclear.

