Question 1 (6 marks)

Question 1a (1 mark)

Flying foxes are a macro-bat found in the southern hemisphere. Unlike other types of bat, flying foxes rely on fruit, leaves or nectar as a food source.

Select the category that best describes a flying fox.

Mammal
Bird
Reptile

Question 1b (2 marks)

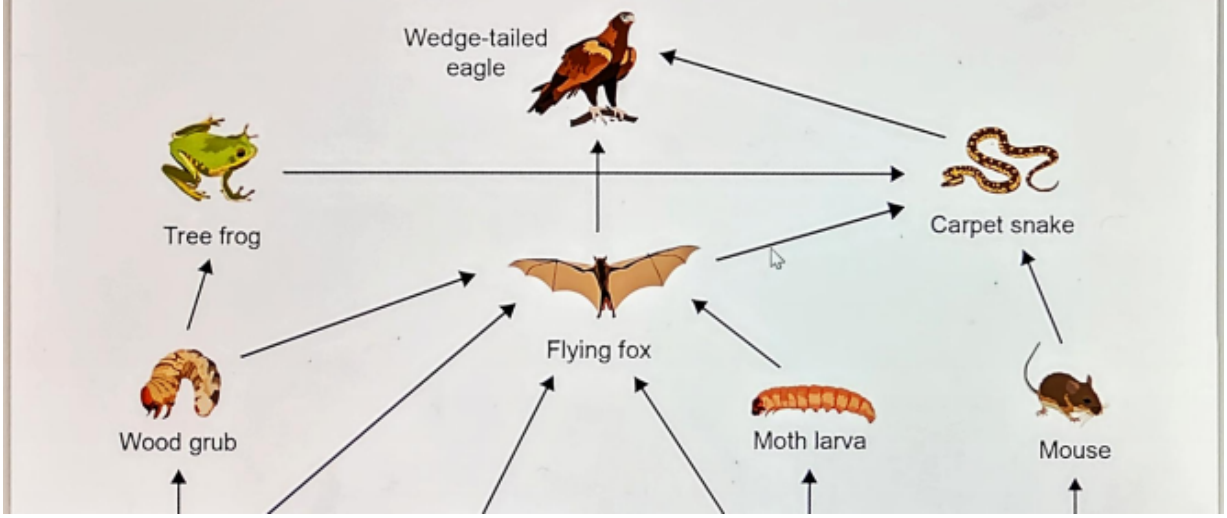
Flying foxes play an important role in pollination and seed dispersal. **State** why these processes are important for plants.

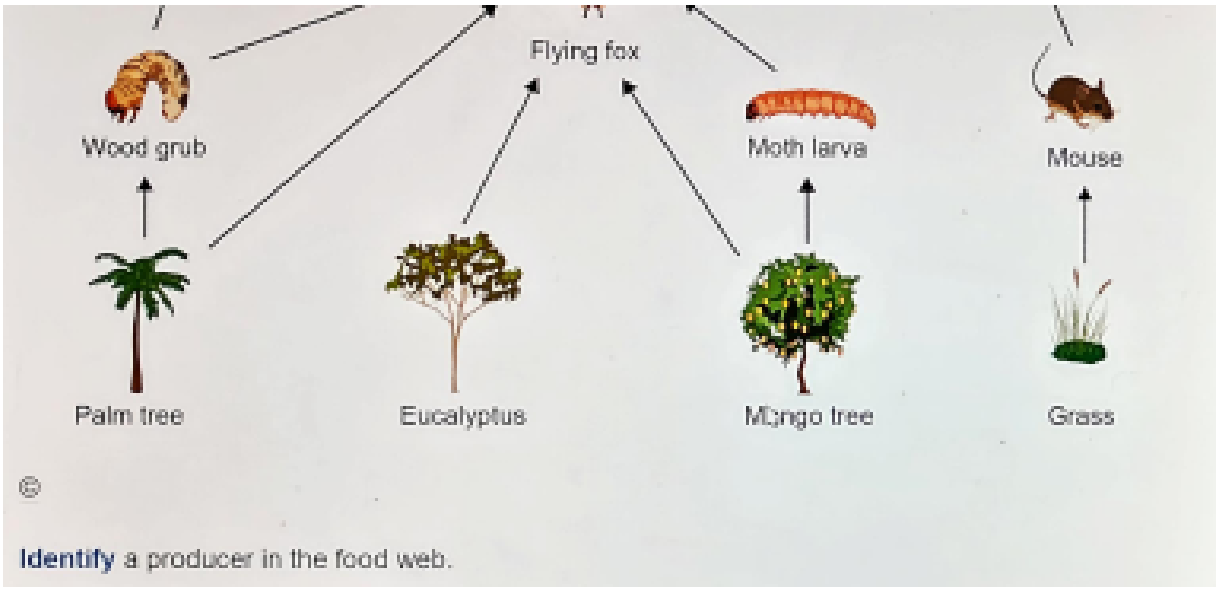
Pollination

Seed dispersal

Question 1c (1 mark)

The food web below shows the feeding relationships in an ecosystem. Flying foxes are a keystone species. The other species in the food web rely on flying foxes for their survival and well-being. The flying foxes live in large colonies in rural and residential areas.





Identify a producer in the food web.

Question 1d (2 marks)

Use the food web to **suggest** one advantage and one disadvantage of flying foxes to mango farmers.

Advantage

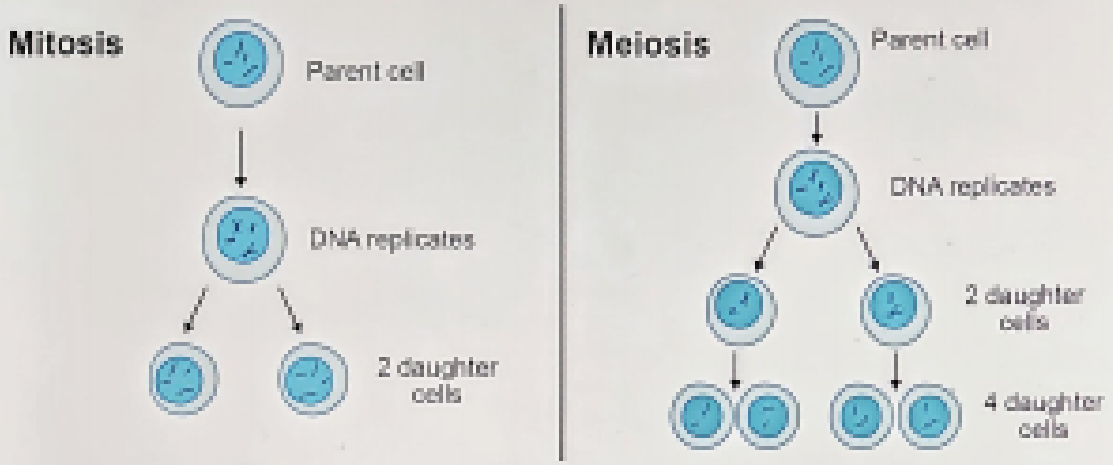
Disadvantage

Styles

Formatting Styles

Question 2a (2 marks)

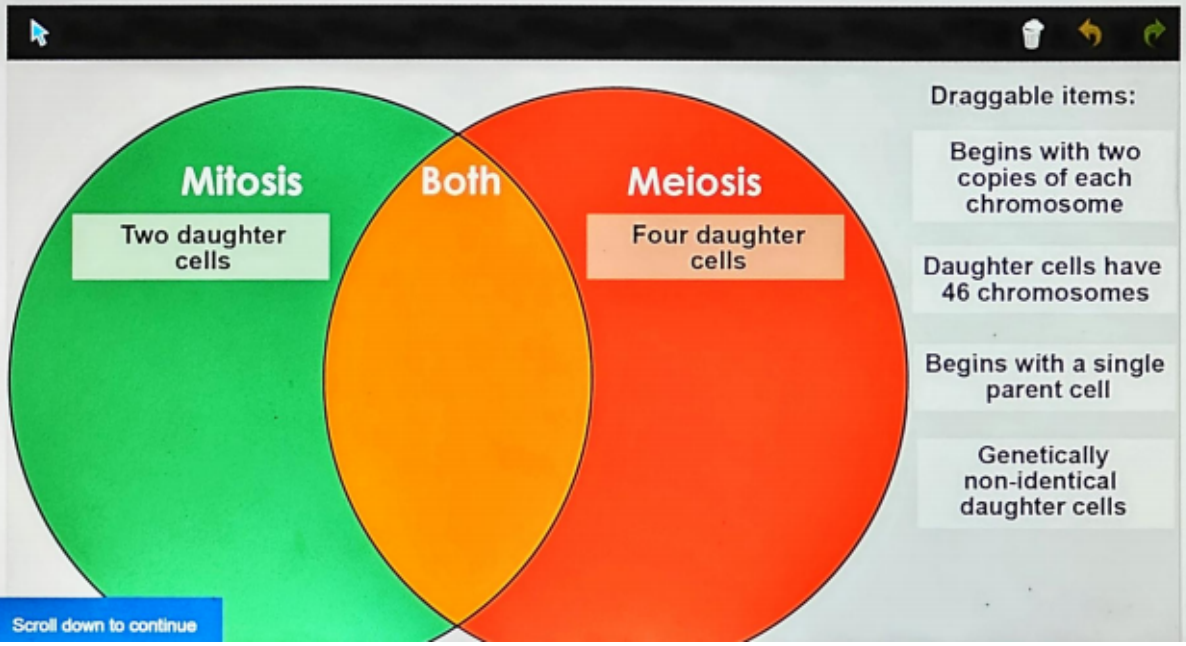
These models represent different processes of cell division.



State two reasons why cells must divide in organisms.

Question 2b (2 marks)

Select similarities and differences between mitosis and meiosis in humans and drag the characteristics to the correct location. The first two have been completed for you.

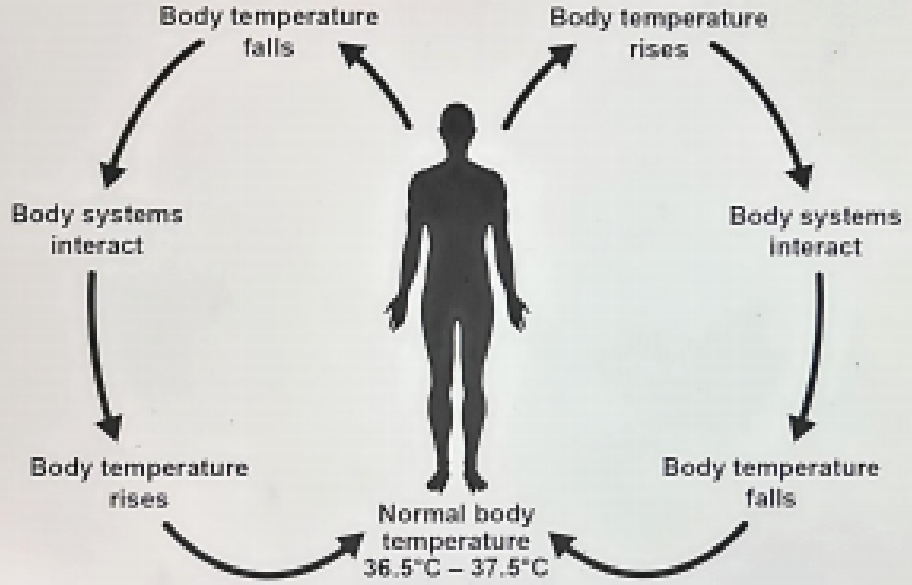


Question 2c (4 marks)

Fertilization is the combination of genetic material from a sperm and an egg. **Explain** how fertilization leads to genetic variation in a population.

Question 3 (10 marks)

This model represents an example of homeostasis in the human body.



Question 3a (2 marks)

Select two body systems that interact to monitor and maintain a constant body temperature.

System to monitor temperature:

perature:

- Excretory system
- Nervous system
- Immune system
- Reproductive system

Question 3a (2 marks)

Select two body systems that interact to monitor and maintain a constant body temperature.

System to monitor temperature:

System to maintain temperature:

Skeletal system
Digestive system
Cardio-vascular system

Question 3b (3 marks)

Using your answer to part (a), **describe** how these two systems work together to respond to a reduction in body temperature.

Question 3c (5 marks)

In order for enzymes to effectively control reactions in the human body, the temperature must remain constant in the range 36.5°C to 37.5°C. **Explain** why enzyme-based reactions in the body are dependent on the temperature not moving outside this range.

Question 4 (17 marks)

Bacteria are simple, single-celled organisms which have no nucleus. There are many different types of bacteria. They can differ in their structure and shape, the environmental conditions in which they can survive, as well as the way they obtain nutrients.

Question 4a (1 mark)

Select which of the following images shows a bacterial cell.

○

○

○

○

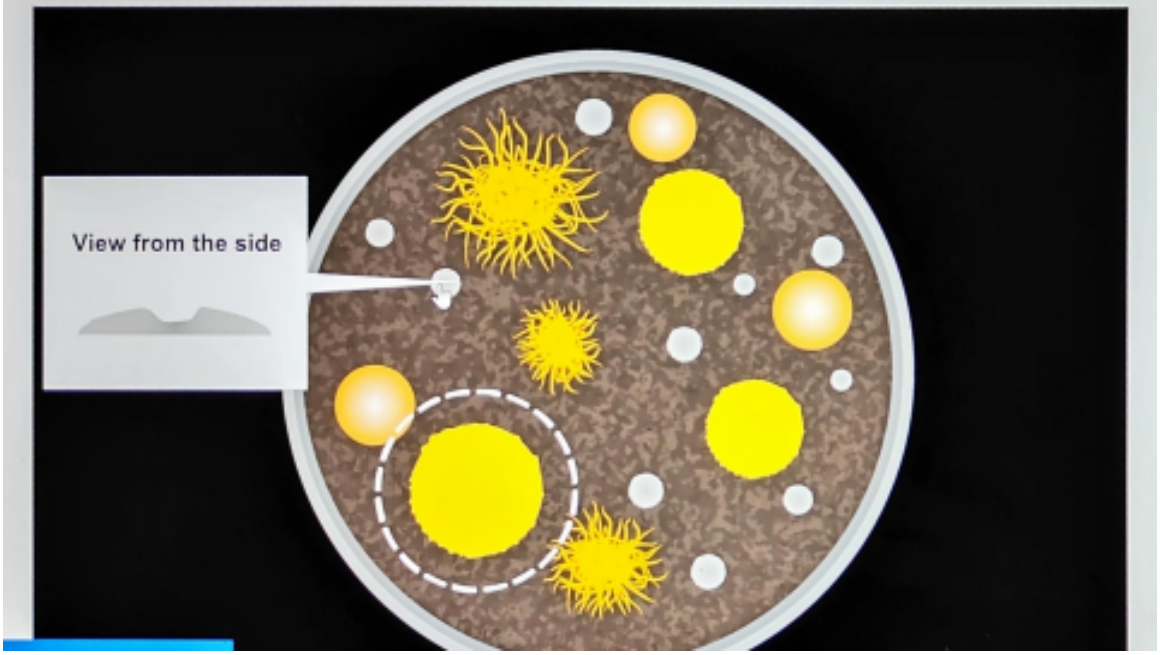
Question 4b (1 mark)

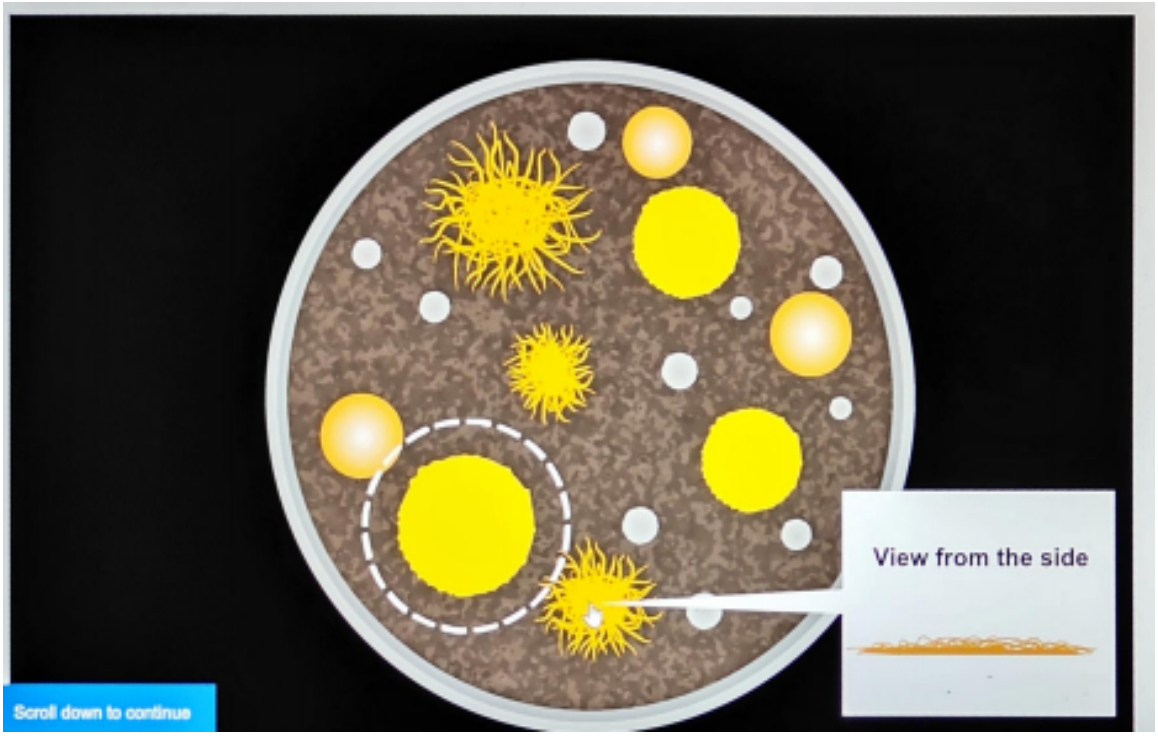
Bacteria have adapted to survive habitats all over the surface of the Earth. They may have beneficial or harmful effects on their environment. As bacteria have very large populations, the effect that they have is quite significant.

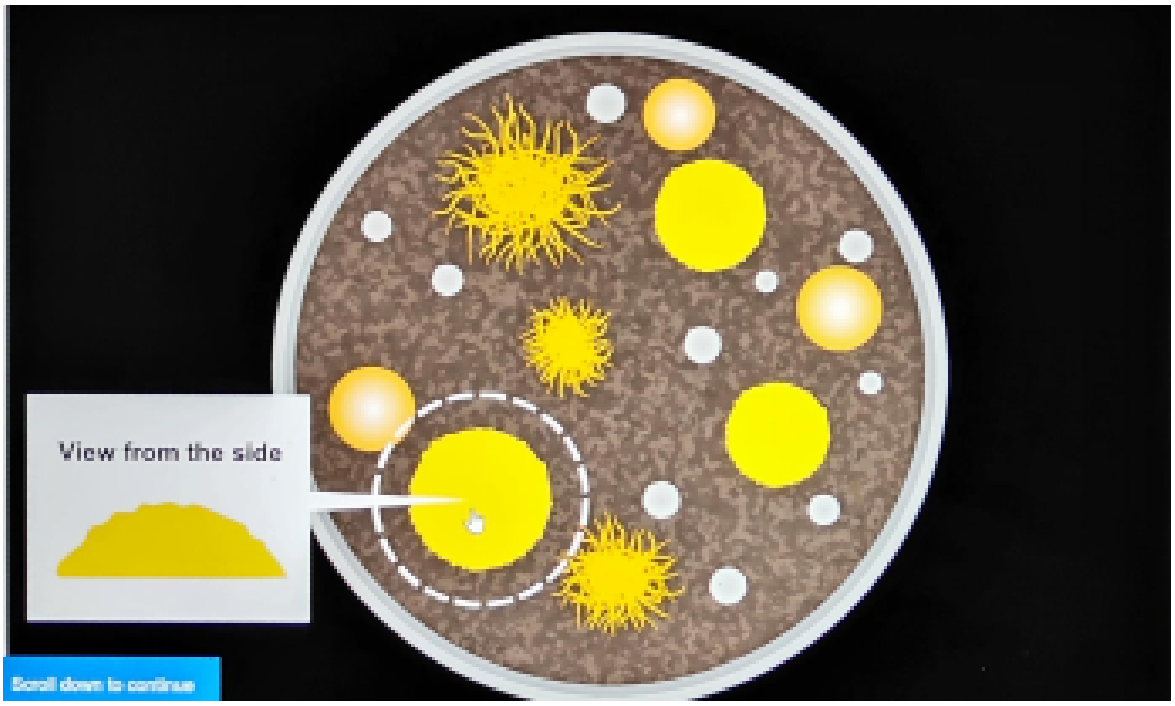
A scientist conducts an experiment to investigate bacteria found on a mobile phone. The images below show the steps of this investigation.

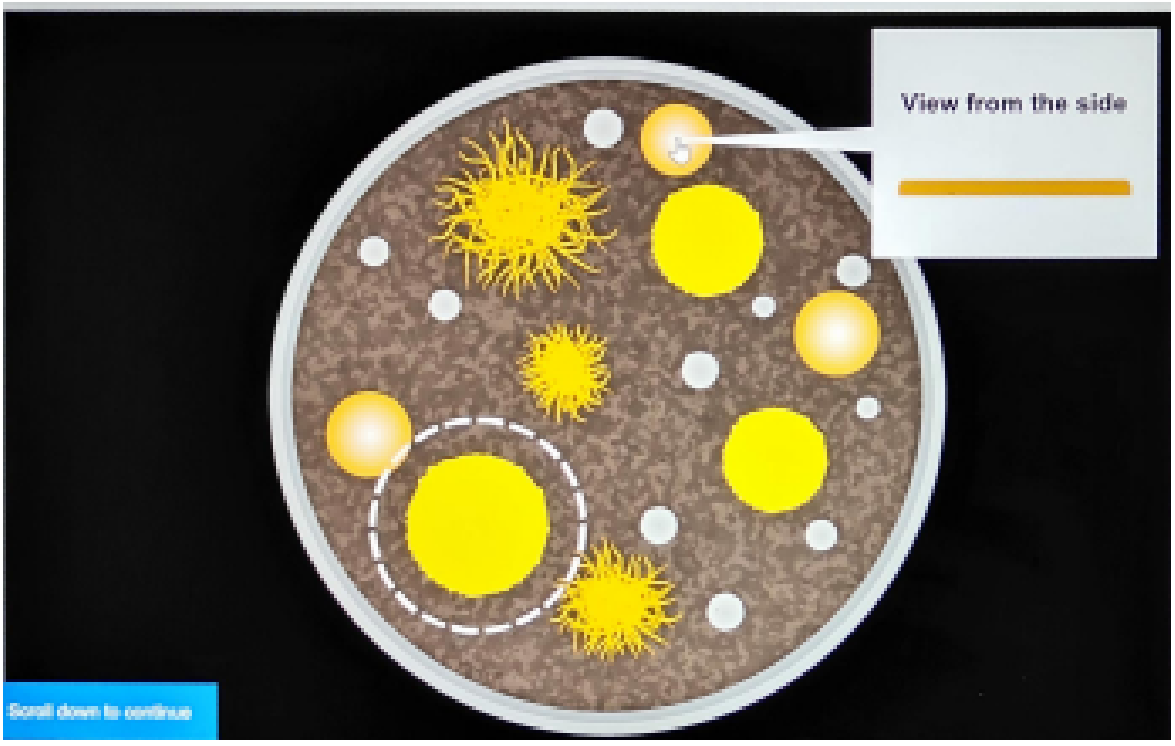
After two days of growth in the incubator, the agar plate appeared as in the image below; several different colonies of bacteria can be seen in this image. Bacteria can be identified by the colour, form and view from the side of their colonies. On this type of agar, the following species of bacteria are commonly observed in the forms shown in the table.

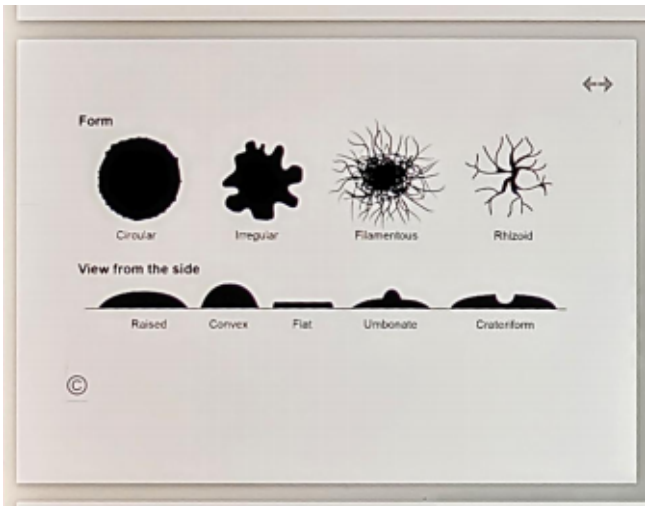
Hover over the different colonies of bacteria for more detail.






View from the side
Scroll down to continue


View from the side
Scroll down to continue



Species of bacteria	Colour	Form	View from the side
A	yellow	circular	convex
B	grey-white	circular	crateriform
C	white	circular	convex
D	yellow	filamentous	flat

Use the chart to **select** the species of the circled bacterial colony based on its appearance.

- A
- B

Question 4c (2 marks)

Identify one qualitative and one quantitative piece of data that could be collected from the bacteria in the agar plate.

Qualitative

Quantitative

Question 4d (2 marks)

Disinfectants can stop the growth of bacteria with varying levels of effectiveness. Scientists can investigate the effects of different substances on bacterial growth using plates prepared with an even layer of a known species of bacteria growing on agar gel. The video below shows a technique which can be used to measure the effectiveness of disinfectant solutions.

The agar plates are pre-prepared with an even layer of a known species of bacteria.

Sterile paper disks are soaked in each of the different liquids.

Using sterile forceps, the disks are transferred to the agar plates.

The agar plates are sealed and placed in an incubator at 24°C for 24 hours.

When in the incubator, the liquids diffuse through the agar. If the bacteria are killed by the disinfectant, a clear zone of no growth is formed around the disk.

After 24 hours, the plates are removed from the incubator and the zone of no growth is measured for each disinfectant.

The sealed plates are sent for safe disposal.

Formulate a research question for the experiment shown in the video.

Question 4e (4 marks)

State the variables for this experiment.

Independent variable

Question 4f (1 mark)

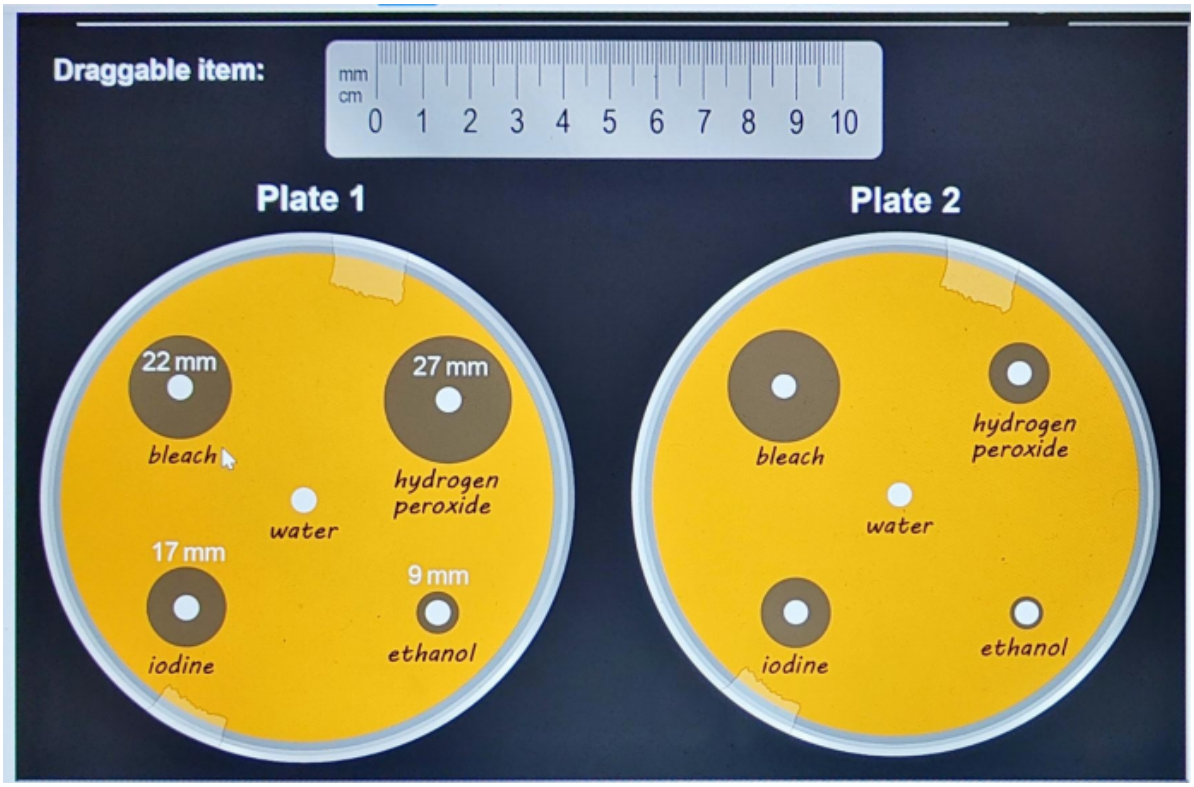
Suggest a reason why water was tested.

Use the ruler to **measure** the zones of no growth surrounding the disks in plate 2. Record your data from plate 2 in the table below.

Liquid	Diameter of zone of no growth on plate 1 / mm	Diameter of zone of no growth on plate 2 / mm
bleach	33	
ethanol	9	
hydrogen peroxide	27	
iodine	17	
water	0	

Question 4g (2 marks)

The appearance of the plates after incubation is shown in the image below.



Question 4h (4 marks)

Outline the strengths and weaknesses of the method.

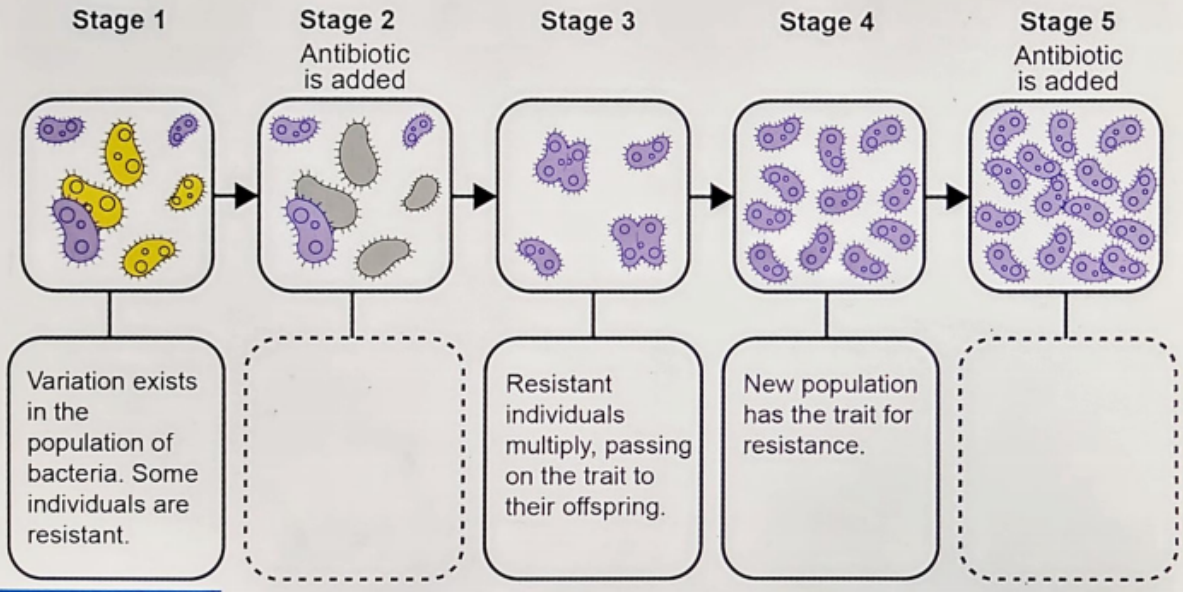
B I | U x_2 x^2 | Ω Σ Styles

Question 5 (15 marks)

Antibiotics are important in the treatment of bacterial infections. They either prevent growth or kill bacteria enabling an organism to fight infection. Some bacteria are no longer killed by certain antibiotics. Once this happens, the bacteria are said to be resistant.

Question 5a (2 marks)

The following diagram shows how bacteria can evolve to become resistant. The bacteria are exposed to the same antibiotic at stages 2 and 5.



The labels for stages 2 and 5 are missing. **Outline** what is happening to the bacteria at each stage.

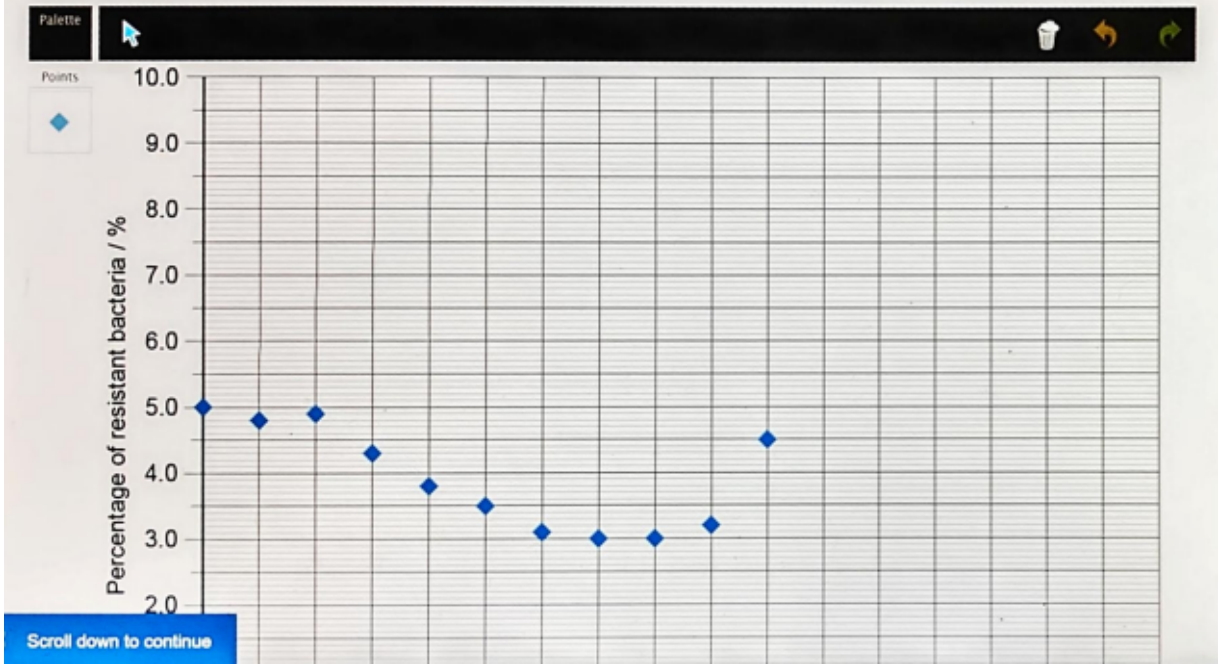
Question 5b (2 marks)

E. coli are common bacteria that can cause serious illness. *E. coli* samples were taken from infected patients and tested for resistance. The percentage of resistant bacteria found over 16 years is shown in the table below:

Year	Resistance (%)
1999	5.0
2000	4.8
2001	4.9
2002	4.3
2003	3.8
2004	3.5
2005	3.1
2006	3.0
2007	3.0
2008	3.2
2009	4.5
2010	6.0
2011	5.0
2012	6.5
2013	8.1
2014	8.9

Scroll down to continue

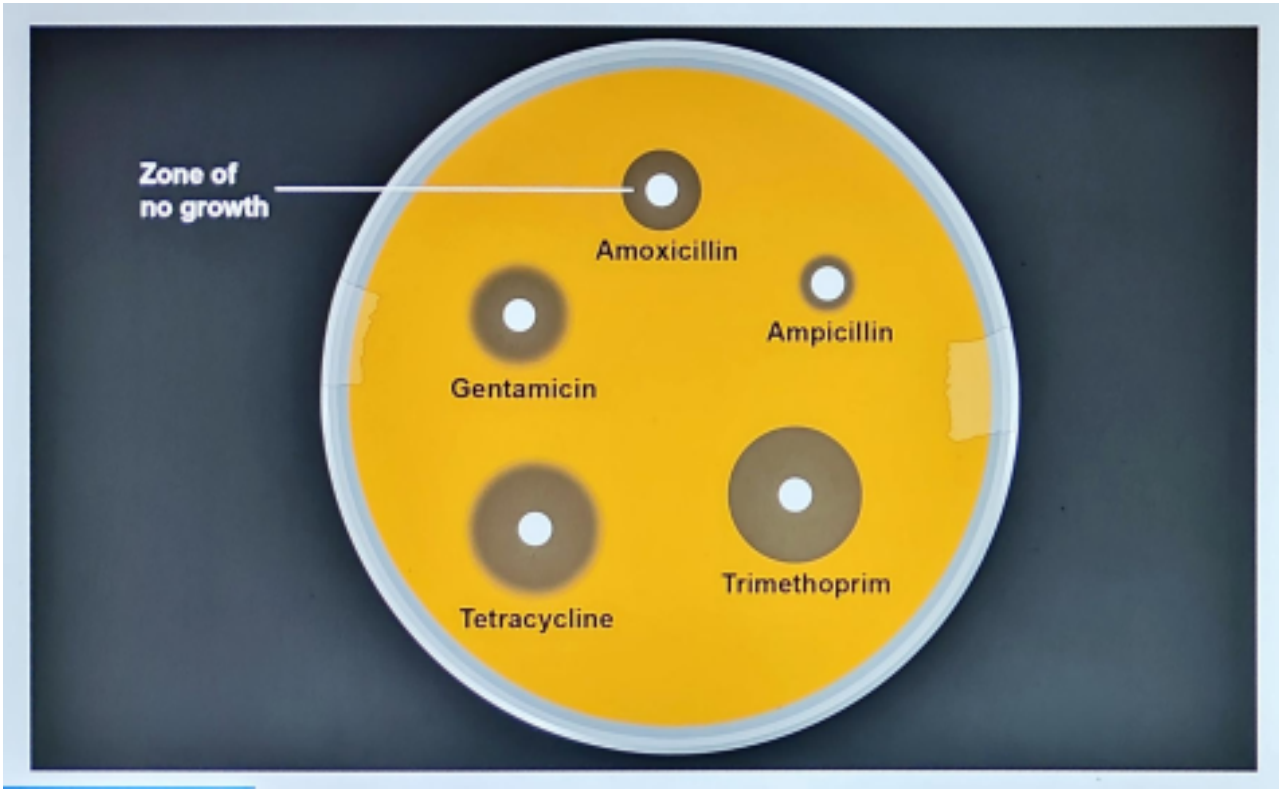
Plot the data from 2010 to 2014 to complete the graph.



Question 5c (3 marks)

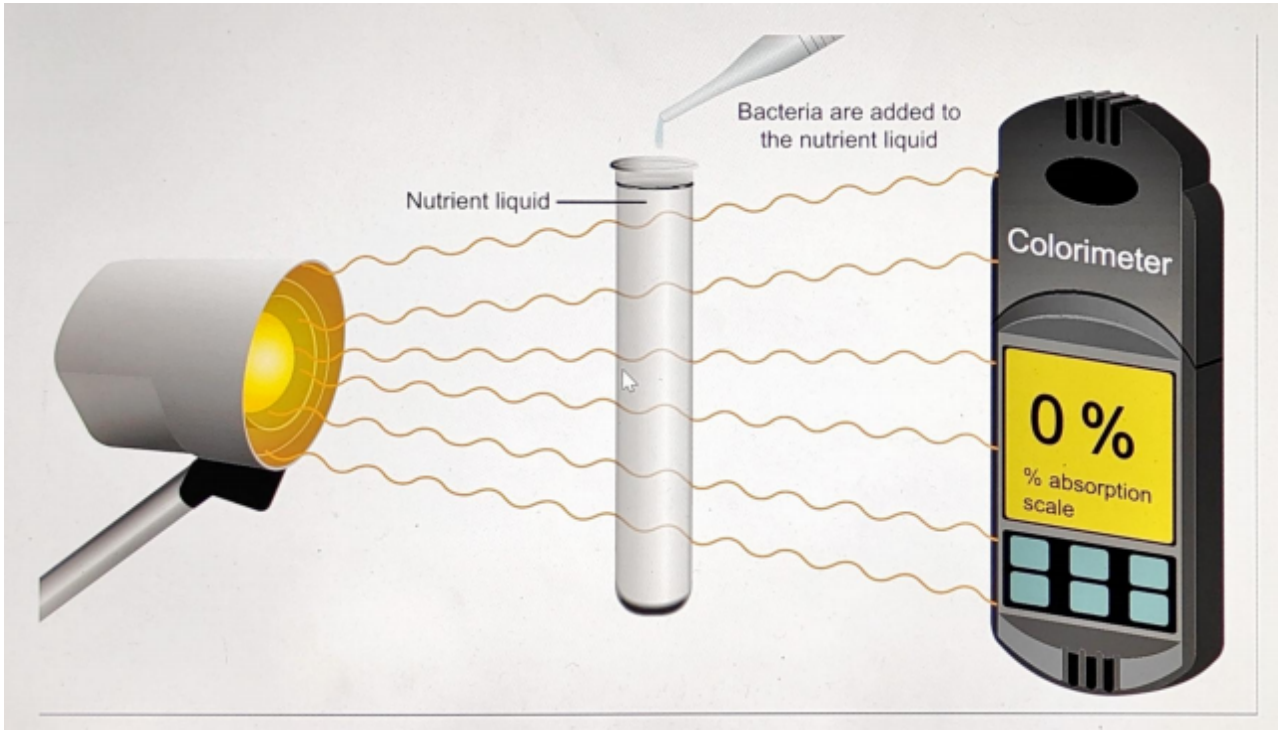
Antibiotics must be used responsibly to reduce the development of antibiotic resistance. When bacteria are killed by an antibiotic, they are said to be sensitive. Responsible use involves health professionals giving their patients an antibiotic to which the bacteria are sensitive, at a concentration strong enough to kill the bacteria.

The effect of several antibiotics was tested using *E. coli* bacteria on an agar plate. Where the bacteria are killed by an antibiotic, a clear zone of no growth is formed. A larger zone of no growth indicates greater sensitivity.



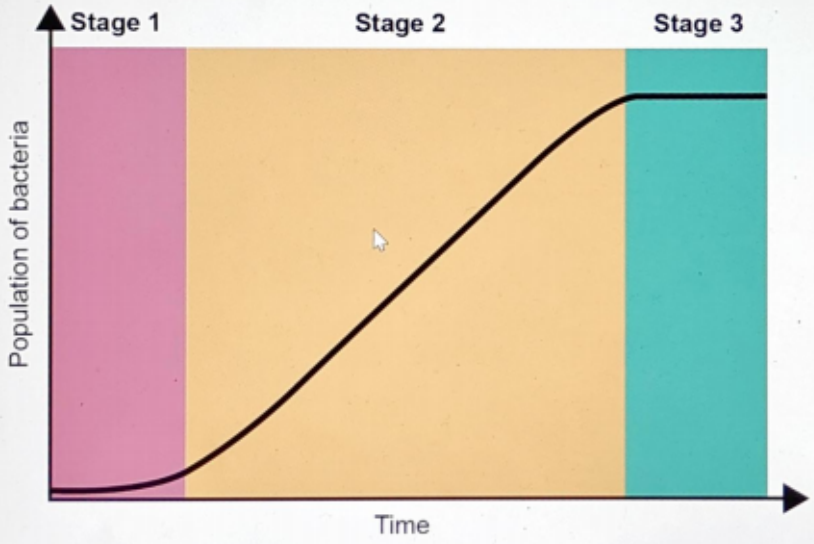
Question 5d (2 marks)

A colorimeter can be used to measure the percentage of light that is absorbed by a liquid. A clear, colourless liquid such as water will have a percentage absorption of 0 %. The animation below shows how the absorption of light changes when bacteria are added to a nutrient solution.



Question 5e (6 marks)

The graph below shows the population growth of bacteria over time, when in a test tube with nutrient liquid.

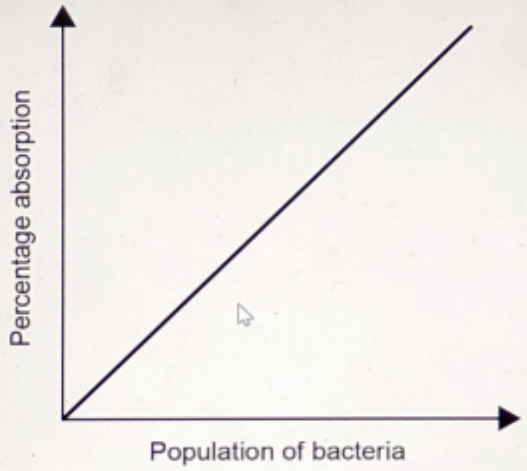


Use the graph to **explain** the change in bacteria population during each stage.

Stage 1

Stage 2

The graph below shows how percentage absorption is related to the population of bacteria.



State the relationship between population of bacteria and percentage absorption of light.

Question 6 (17 marks)

You should not attempt to answer question 6 until you have answered question 5.

All food has a small number of bacteria growing on its surface. In small numbers, these bacteria are harmless, but if these bacteria multiply, the food spoils and can become harmful to eat. Preservatives are chemicals used to slow or prevent the growth of bacteria in food which prolongs the time that food can be stored. Salt has been used as a method of food preservation for millennia as it is readily available all over the world.

You are provided with standard laboratory equipment, a colorimeter and the following liquids:

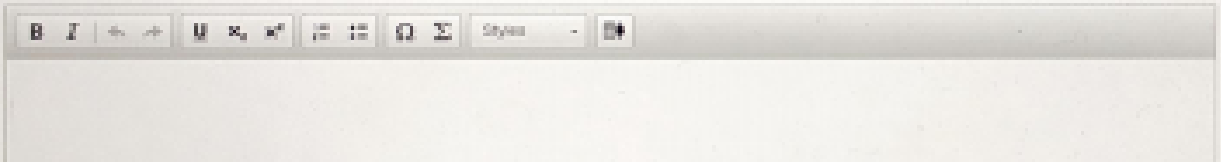
- A liquid containing bacteria
- Nutrient liquid
- A range of salt solutions with concentrations from 0 % to 10 %.

Design an investigation into the effect of a salt solution on bacterial growth. In your answer, you should:

- identify the independent and dependent variables
- include two control variables
- formulate a testable hypothesis with a scientific explanation
- describe how to manipulate, measure or monitor all of the variables

Design an investigation into the effect of a salt solution on bacterial growth. In your answer, you should:

- identify the independent and dependent variables
- include two control variables
- formulate a testable hypothesis with a scientific explanation
- describe how to manipulate, measure or monitor all of the variables
- describe the method to collect sufficient data
- list any safety considerations.



Question 7 (12 marks)

Changes in human lifestyles, in particular diet and activity, have led to increased levels of cardiovascular diseases. Cardiovascular disease is a term used to describe diseases of the heart and blood vessels. This is one of the most common causes of death, accounting for 31 % of global deaths annually. Advances in medicine have reduced the chance of death from cardiovascular disease. The video below gives some information about one of the causes of cardiovascular disease.

Cholesterol is a substance that is found in all body cells – it has an important function in cell membranes and is also used to make essential substances, including some hormones and vitamins.

The body makes the cholesterol it needs in the liver. However, cholesterol is also found in some foods, such as eggs, meat, and cheese.

Too much cholesterol in the body can lead to atherosclerosis. If untreated, atherosclerosis can result in the development of cardiovascular diseases, such as coronary heart disease.

The most common cause of high cholesterol is an unhealthy lifestyle. A diet rich in salty, sugary and processed foods, a lack of physical activity, and smoking are some of the contributing factors.

However, cholesterol levels also increase naturally with age, high cholesterol runs in some families, and certain ethnic groups have naturally higher cholesterol levels.

Cholesterol levels can be easily monitored with simple blood tests. High levels are usually managed by adopting a healthier lifestyle, although medical and surgical interventions also exist. Detecting and treating high cholesterol levels early significantly reduces the risk of further complications.

Question 7a (3 marks)

Suggest how atherosclerosis may lead to an increased chance of coronary heart disease.

B I U x_2 x^2 Ω Σ Styles

Question 7b (3 marks)

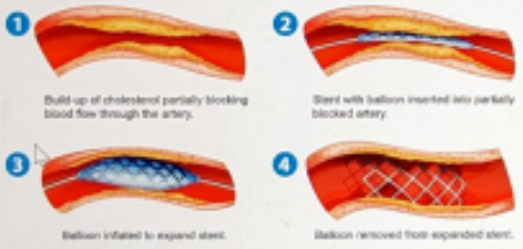
The surgical and medical interventions shown below can be used to reduce the effects of atherosclerosis.

Question 7c (2 marks)

Suggest how statins may reduce cholesterol levels.

Surgical intervention – angioplasty

In an angioplasty, a tube called a stent is placed into an artery to keep it open.



Medical intervention – statins

Enzymes catalyse the conversion of substance A into cholesterol in the liver. Statins block the action of these enzymes. Statins are a form of medication that are commonly taken in tablet form.

Describe how angioplasty and a stent lead to a reduction in blood pressure.

Question 7d (4 marks)

Suggest one advantage and one disadvantage for each of the interventions described above.

Angioplasty

Advantage

Statins

Advantage

Question 8 (15 marks)

A healthy lifestyle is always recommended to prevent and treat cardiovascular diseases caused by atherosclerosis. The interactive graphic below gives some information about aspects of a healthy lifestyle.

This media is interactive

Using information from the infographic and knowledge from your wider MYP studies, **discuss** and **evaluate** the impact of lifestyle choices. In your answer, you should include:

- how an individual's quality of life may be impacted by cardiovascular disease
- economic advantages and disadvantages of adopting a healthy lifestyle
- a justification of whether good health is the responsibility of the individual
- a justification of whether good health is the responsibility of the society
- a concluding statement.