

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Thursday 28 May 2026

Afternoon (Time: 1 hour 45 minutes)

Paper reference **WBI14/01**

Biology

International Advanced Level

UNIT 4: Energy, Environment, Microbiology and Immunity

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- In the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

- 1 Human immunodeficiency virus (HIV) and tobacco mosaic virus (TMV) are two types of viruses.

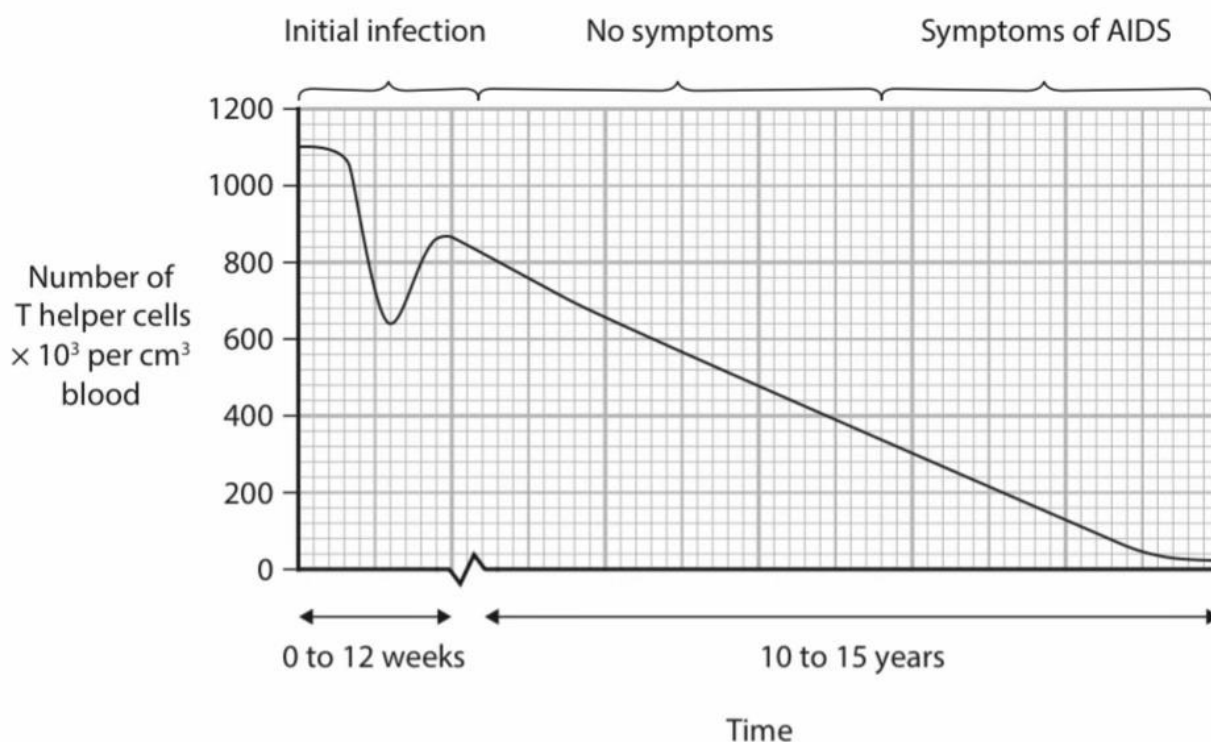
(a) The table shows some information about the structure of HIV and TMV.

Put **one** cross ☐ in the appropriate box in **each** row to show whether the structure is present in these viruses.

(3)

Structure	Structure found in			
	HIV only	TMV only	both HIV and TMV	neither HIV nor TMV
RNA	☐	☐	☐	☐
capsid	☐	☐	☐	☐
envelope	☐	☐	☐	☐

- (b) The graph shows the changes in the number of T helper cells following infection with HIV.



- (i) Calculate the total number of T helper cells in the blood of an uninfected person.

Assume the volume of blood in this person is 5 dm^3 .

Give your answer in standard form.

(2)

Answer

(ii) Explain why there is a delay between the initial infection and the symptoms of AIDS developing.

(3)

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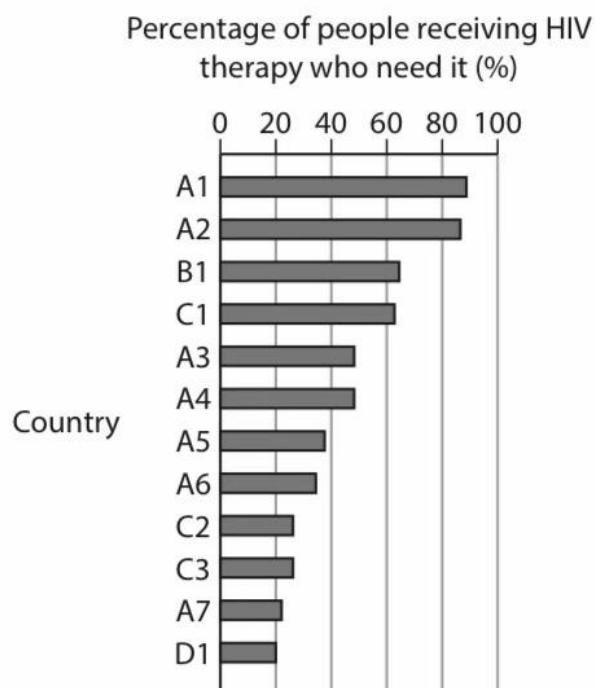


- (c) The chart shows the people receiving HIV therapy as a percentage of those who need it.

The data is from some of the countries within different continents.

Each continent is represented by a different letter: A, B, C and D.

Each country in a continent is represented by a different number.



Some scientists concluded that HIV therapy is more available in some continents than others.

Other scientists do not agree with this claim.

Give **two** reasons why valid conclusions **cannot** be made about the availability of HIV therapy in the different continents of the world.

(2)

(Total for Question 1 = 10 marks)



2 Kaibab squirrels evolved from Abert's squirrels.

The photographs show an Abert's squirrel and a Kaibab squirrel.



(Source: © THOMAS & PAT LEESON / SCIENCE PHOTO LIBRARY)

Abert's squirrel



(Source: © Robert E. Barber / Alamy Stock Photo)

Kaibab squirrel

(a) The table shows the range of sizes of these two squirrels.

Type of squirrel	Length of head and body / cm	Length of tail / cm	Total length of squirrel / cm
Abert's squirrel	46 to 58	19 to 25	65 to 83
Kaibab squirrel	 to 58	 to 25	 to 83

- (i) The length of head and body of the shortest Kaibab squirrel is 18 inches, and the length of its tail is 7 inches.

Complete the table to show the **three** missing lengths for the smallest Kaibab squirrel in centimetres.

1 inch = 2.5 cm

(1)



(ii) Comment on the relative lengths of these two squirrels.

Use the information in the table to support your answer.

(2)

(b) Abert's squirrels are found on the south side of the Grand Canyon and Kaibab squirrels are found on the north side of the Grand Canyon.

The Grand Canyon, a deep V-shaped valley, was formed by the Colorado River eroding the rock layers over millions of years.

The Abert's squirrels occupied the area before the canyon was formed.

(i) Explain how the Kaibab squirrels could have evolved from the Abert's squirrels.

(4)

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(ii) It is thought that Kaibab squirrels appeared about 10 000 years ago.

Scientists believe that these two types of squirrels are sub-species but will eventually evolve into different species.

Suggest why scientists believe this.

(2)

(Total for Question 2 = 9 marks)



3 The fungus *Fusarium oxysporum* is a filamentous microorganism.

It consists of long threads called hyphae.

Each hypha is composed of extended cells with many nuclei.

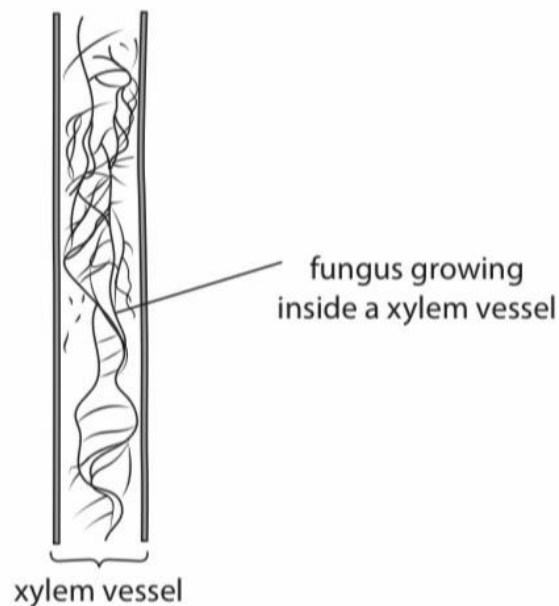
The diagram shows part of a hypha.



This fungus infects banana plants and causes wilting disease.

The fungus grows in the xylem and is transported upwards in the plant.

The diagram shows this fungus starting to spread inside a xylem vessel.



(a) Explain why the banana plant wilts as this fungus spreads in the xylem.

Use the information in the diagram to support your answer.

(3)

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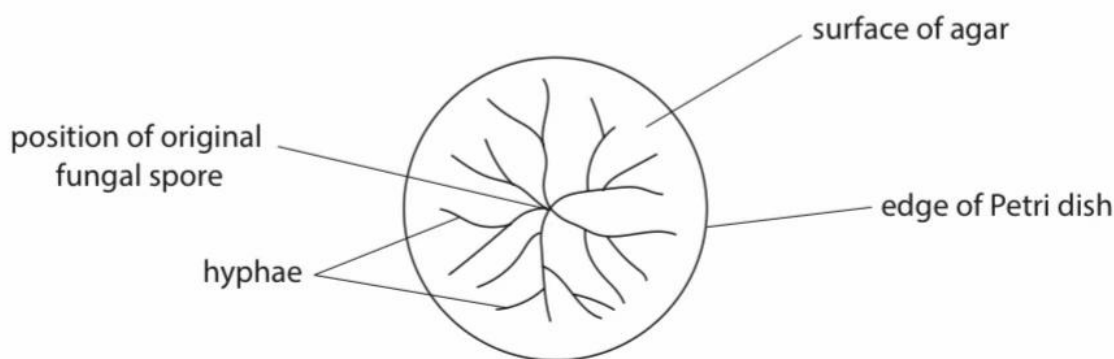
(b) A fungus can be grown on nutrient agar.

A fungal spore is put onto the surface of the agar in a Petri dish.

The Petri dish is incubated at a suitable temperature and hyphae grow out from the spore.

The hyphae release enzymes to digest the nutrients in the agar and then absorb the digested nutrients.

The diagram shows the appearance of a fungus growing on the surface of nutrient agar after four days.



Magnification $\times 0.5$

(i) The diameter of this Petri dish is 80 mm.

Estimate the **mean** growth rate of this fungus, giving suitable units.

Explain how you arrived at your answer.

Use the information in the diagram to support your answer.

(3)

Answer

Explanation

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Describe how this method for growing a fungus could be used to measure the growth rate **using mass**, after the lag phase.

(Total for Question 3 = 10 marks)



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- 4 Chloroplasts in the leaves of plants maximise light absorption by using different types of pigments.
- (a) Describe a method that uses chromatography to identify the types of pigments in a leaf.

(3)

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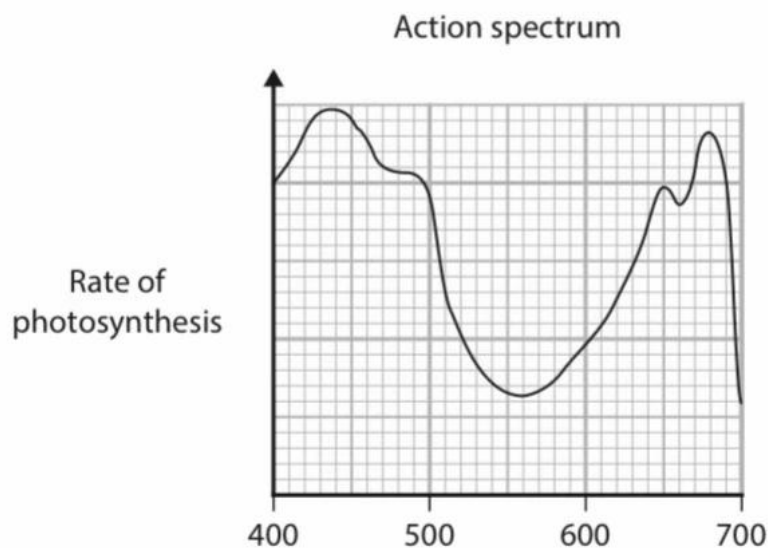
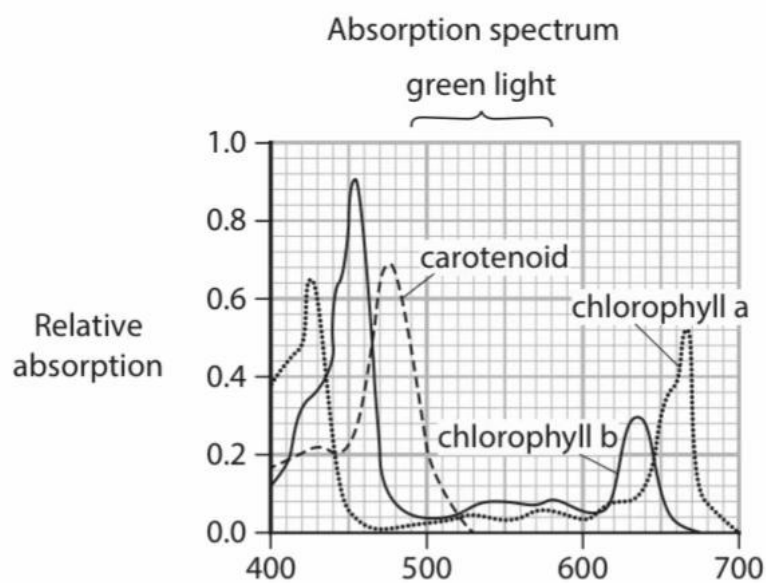
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- (b) The graphs show an absorption spectrum and an action spectrum for one species of plant.



- (i) Give **one** appropriate label, including units, for the x axis for these two graphs.

(1)

- (1)

- ☐ **A** $\mu\text{g biomass hour}^{-1}$
- ☐ **B** $\mu\text{g biomass hour}^{-2}$
- ☐ **C** $\mu\text{m biomass hour}^{-1}$
- ☐ **D** $\mu\text{m biomass hour}^{-2}$

- Use the information in the graphs to support your answer.

(4)

(Total for Question 4 = 9 marks)



- 5 Many plants produce chemicals that have medicinal effects on humans and other animals, including wild chimpanzees.

Scientists investigated the anti-inflammatory and antibiotic properties of plants that wild chimpanzees were eating in a forest reserve in Uganda.

The photograph shows a wild chimpanzee in Uganda.



(Source: © Cavan Images/Getty Images)

- (a) The scientists observed a chimpanzee with an injured hand eating the leaves of a plant.

The chemicals in the plant reduced the inflammation around the injury.

Give **one visible** sign of reduced inflammation.

(1)

(b) Scientists made extracts from parts of the plants that they had observed the chimpanzees eating and tested them for their antibiotic properties.

(i) Describe how these extracts could be tested for their antibiotic properties.

(3)

(ii) Extracts of three parts of the plant were made, each using different solvents.

Explain **one** reason for using different solvents to make these extracts.

(2)

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(c) Explain why it is important to maintain plant biodiversity as part of an 'evolutionary race' against pathogens.

(3)

(Total for Question 5 = 9 marks)

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- 6 Hawaii is home to a number of species of honeycreepers.

The number of these birds is decreasing due to malaria, a disease transmitted by female mosquitoes.

The photograph shows one species of honeycreeper.



(Source: © Thomas Chlebecek/Shutterstock)

- (a) (i) There were 56 native species of honeycreeper and 39 of these species are now extinct.

Calculate the percentage of species of honeycreepers that are extinct.

Give your answer to **two** significant figures.

(1)

Answer%

- (ii) Of the remaining 17 species, 11 species are endangered.

Calculate the ratio of endangered species : non-endangered species.

Give your answer to one decimal place.

(1)

Answer : 1

(b) The mosquitoes carrying malaria were introduced onto the islands in the 1800s.

The honeycreepers have no immunity to the pathogen that causes malaria.

They can die after a single bite from a female mosquito.

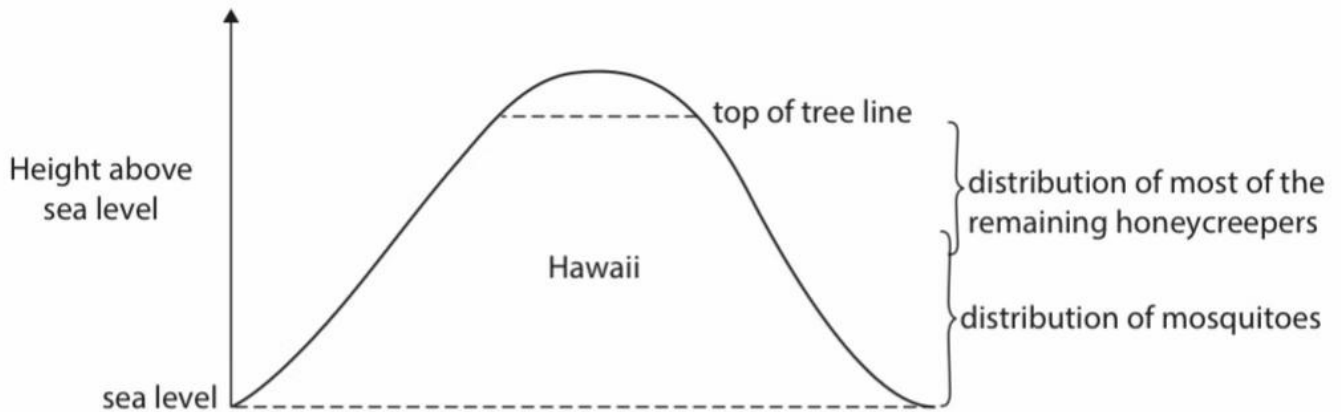
Suggest why these honeycreepers have not developed immunity to this disease.

(3)



(c) The diagram shows the distribution of most of the remaining honeycreepers and the distribution of mosquitoes in Hawaii.

Atmospheric temperature decreases with height above sea level.



Conservationists are worried that global warming could further increase the number of honeycreepers dying from malaria.

Explain why global warming could further increase the number of honeycreepers dying from malaria.

Use the information in the diagram to support your answer.

- (d) The incompatible insect technique (IIT) is a method used to control mosquito populations.

Male mosquitoes that have been infected with Wolbachia bacteria are released into the wild.

The eggs of a wild female mosquito cannot hatch when she has mated with an infected male mosquito.

Every week, 250 000 infected male mosquitoes are released on Hawaii.

- (i) Calculate how many infected male mosquitoes will be released in a 40-week period.

Give your answer in standard form.

(1)

Answer

- (ii) Suggest **two** reasons why large numbers of mosquitoes have to be released over a long period of time.

(2)

(Total for Question 6 = 12 marks)



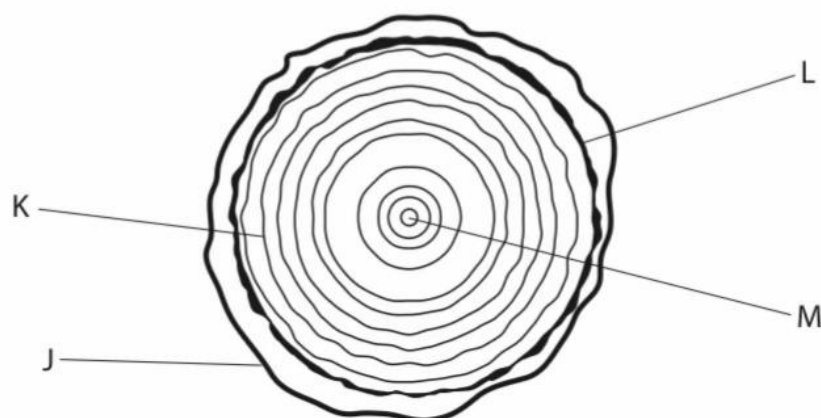
7 Tree rings can be used to determine the age of a tree and as evidence for climate change.

(a) Which is the term for the use of tree rings to determine the age of a tree?

(1)

- ☐ A colonisation
- ☐ B dendrochronology
- ☐ C entomology
- ☐ D extrapolation

(b) The diagram shows a section through a part of a tree.



(i) Which is the location of xylem?

(1)

- ☐ A J
- ☐ B K
- ☐ C L
- ☐ D M

(ii) Which is the age of this tree?

(1)

- ☐ A 10 years old
- ☐ B 11 years old
- ☐ C 20 years old
- ☐ D 22 years old



(iii) From which part of the tree should a section be taken to determine the age of the tree?

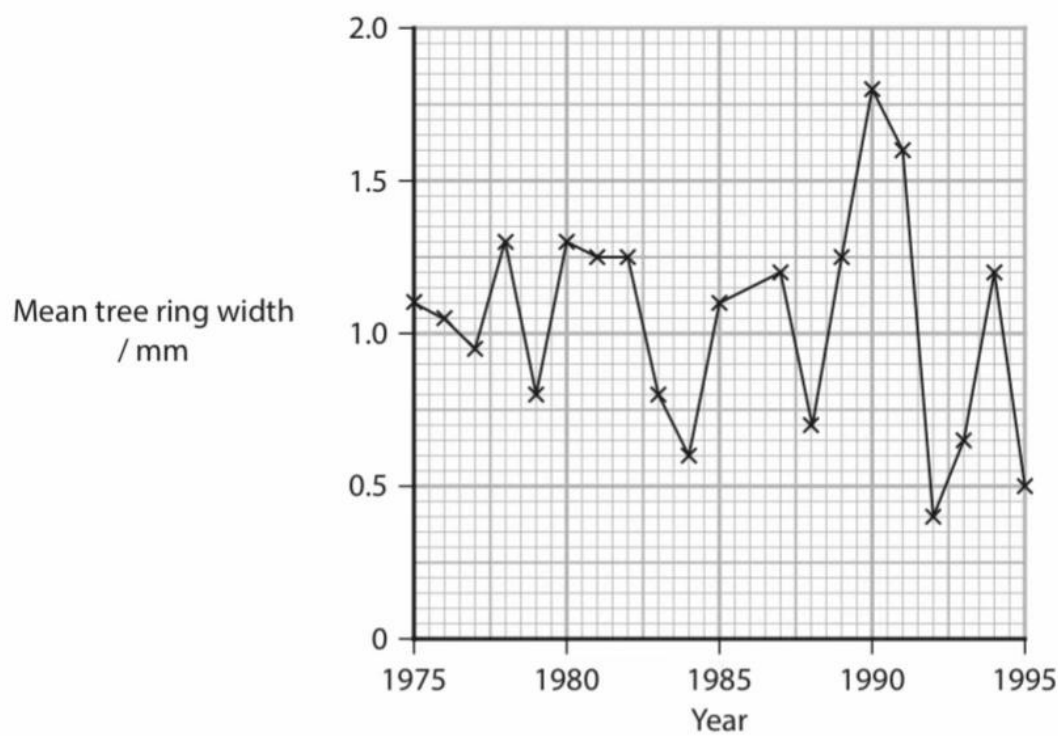
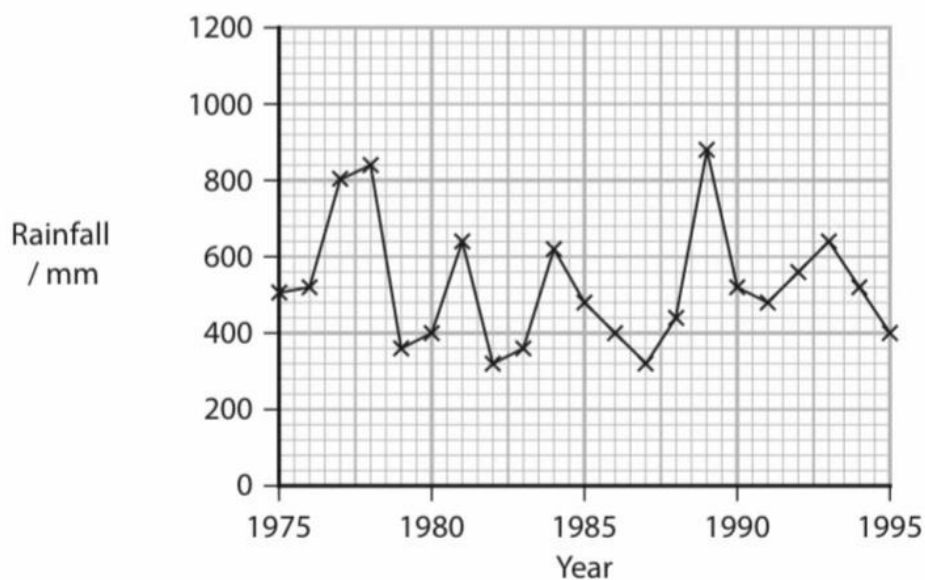
(1)

- ☐ **A** bottom of first branch
- ☐ **B** bottom of trunk
- ☐ **C** narrowest part of trunk
- ☐ **D** top of first branch



- (c) A study in Africa looked at the pattern of rainfall and the mean tree ring width in one location, from 1975 to 1995.

The graphs show the results of this study.



Discuss the extent to which these results indicate that there is a relationship between rainfall and tree ring growth.

Use examples from the graphs to support your answer.

(5)

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(d) Climate change includes a change in mean temperature.

Explain why a change in mean temperature affects the tree ring width.

(3)

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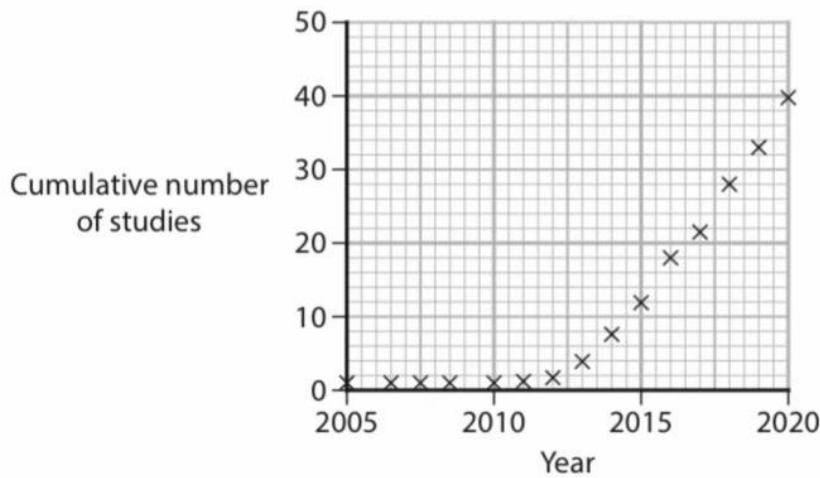
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(e) Climate change was studied in Bhutan from 2005 to 2020.

The graph shows the cumulative number of published studies that used the width of tree rings.



- (i) Calculate the mean rate of increase in the number of published studies per year from 2012 to 2020.

(1)

Answer studies per year

- (ii) Explain the changes in the number of studies from 2005 to 2020.

(2)

(Total for Question 7 = 15 marks)

8 The human body has barriers to infection.

The gut flora is one of these barriers.

(a) Which of the following are also barriers that protect the body from pathogens entering tissues?

(1)

- ☐ A interferon and lysozyme
- ☐ B inflammation and skin
- ☐ C lysozyme and inflammation
- ☐ D stomach acid and skin

(b) Explain how the gut flora keeps us healthy.

(2)

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*(c) Antibiotics can affect the gut flora of a person.

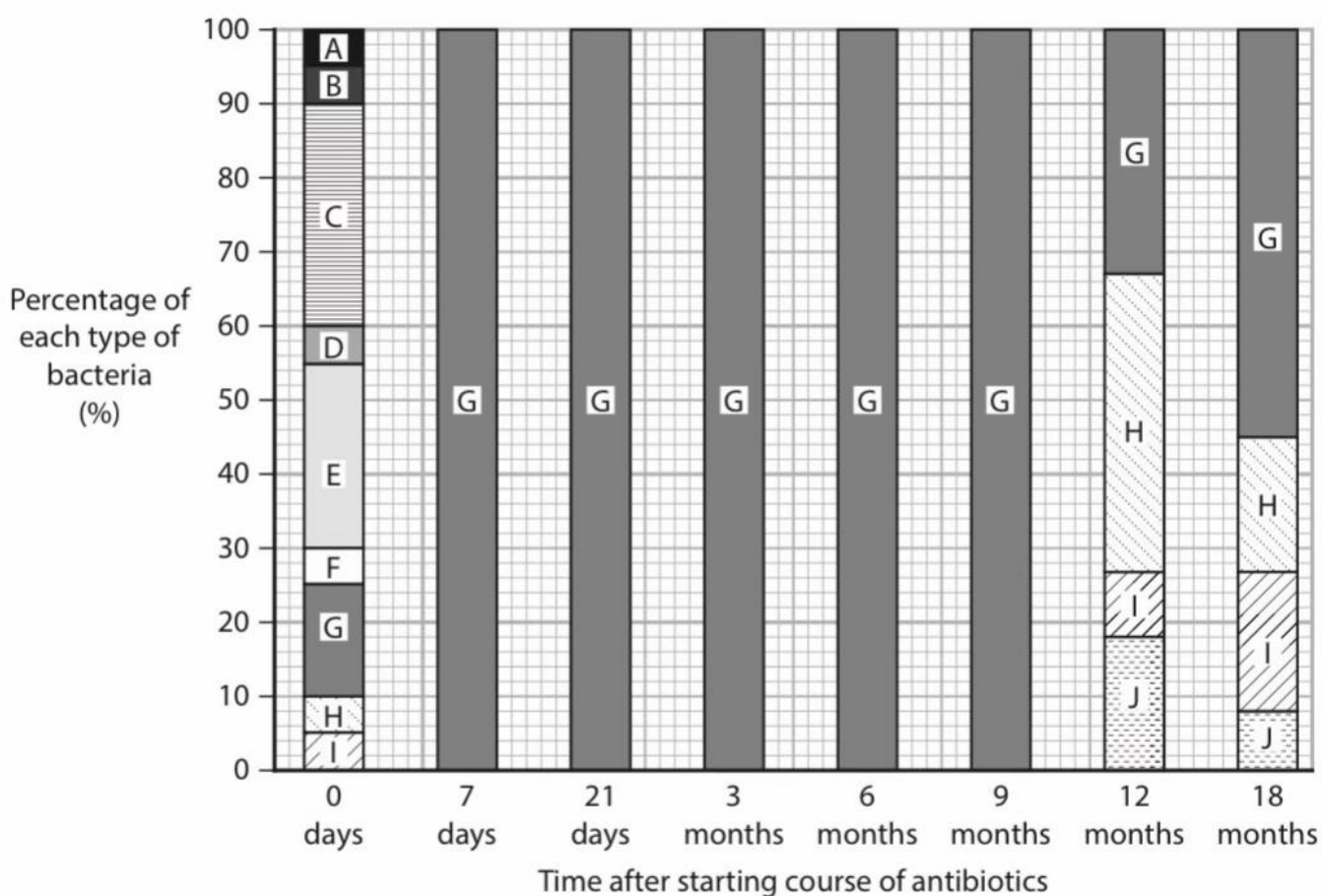
In an investigation, a person took a course of antibiotics for seven days.

The percentage of each type of bacteria in the gut flora was recorded:

- before the antibiotics were taken (day 0)
- at the end of the course of antibiotics (day 7)
- at intervals up to 18 months after starting the course of antibiotics.

The graph shows the results of this investigation.

Each type of bacteria is represented by a different letter.



Explain the changes in the percentages of each type of bacteria during this investigation.

(6)

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- (d) A group of scientists investigated the gut flora of foals (young horses) bred for racing.

The photograph shows a racehorse and her foal.



(Source: George Impey / Alamy Stock Photo)

The scientists collected faeces from the foals, as they grew up, and analysed them for bacterial DNA.

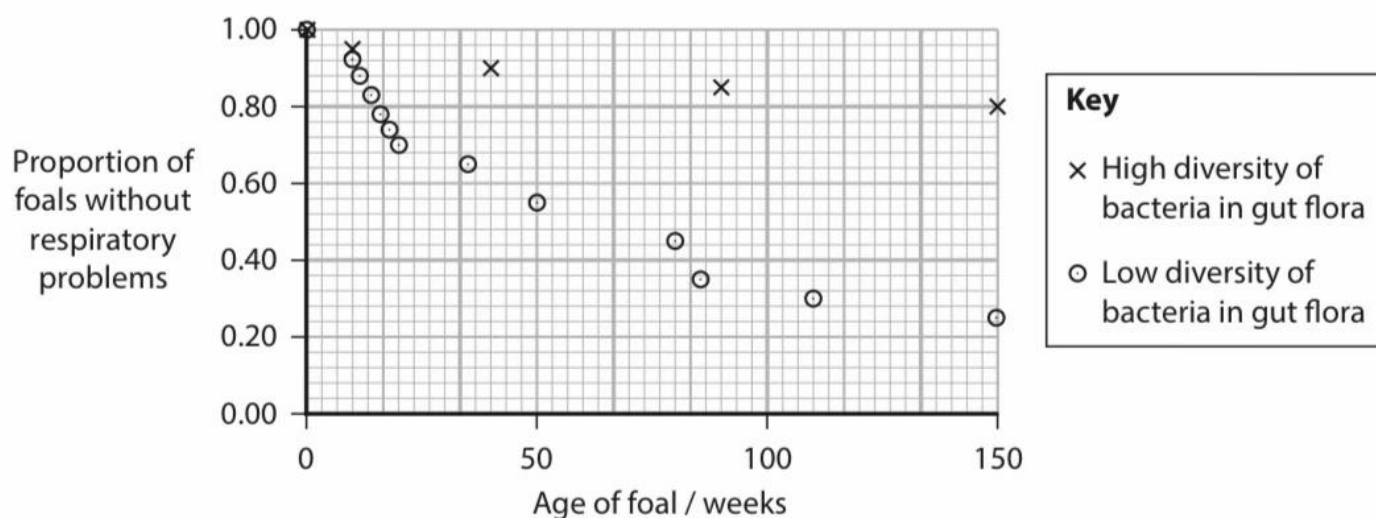
The health of the animals was monitored and their success in winning races recorded.

- (i) Describe how the DNA in the faeces could be analysed to determine the diversity of bacteria in the gut flora.

(3)

(ii) Foals can develop respiratory problems that can affect their racing success.

The graph shows the proportion of foals **without** respiratory problems in the first 150 weeks of their lives.



Describe the changes in the relationships between the gut flora and respiratory problems of these two groups of foals.

(2)

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P 7 9 2 1 4 A 0 3 9 4 0

(iii) Explain why respiratory problems could affect the chance of a horse winning a race.

(2)

(Total for Question 8 = 16 marks)

TOTAL FOR PAPER = 90 MARKS

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