

Pearson Edexcel International Advanced Level

Thursday 28 May 2026

Afternoon (Time: 1 hour 45 minutes)

**Paper
reference**

WBI14/01A

Biology

International Advanced Level

**UNIT 4: Energy, Environment, Microbiology and Immunity
Question Paper**

You must have: Answer Book (sent separately)

Scientific calculator, ruler, HB pencil

Do not return this question paper with the answer book.

Turn over ►

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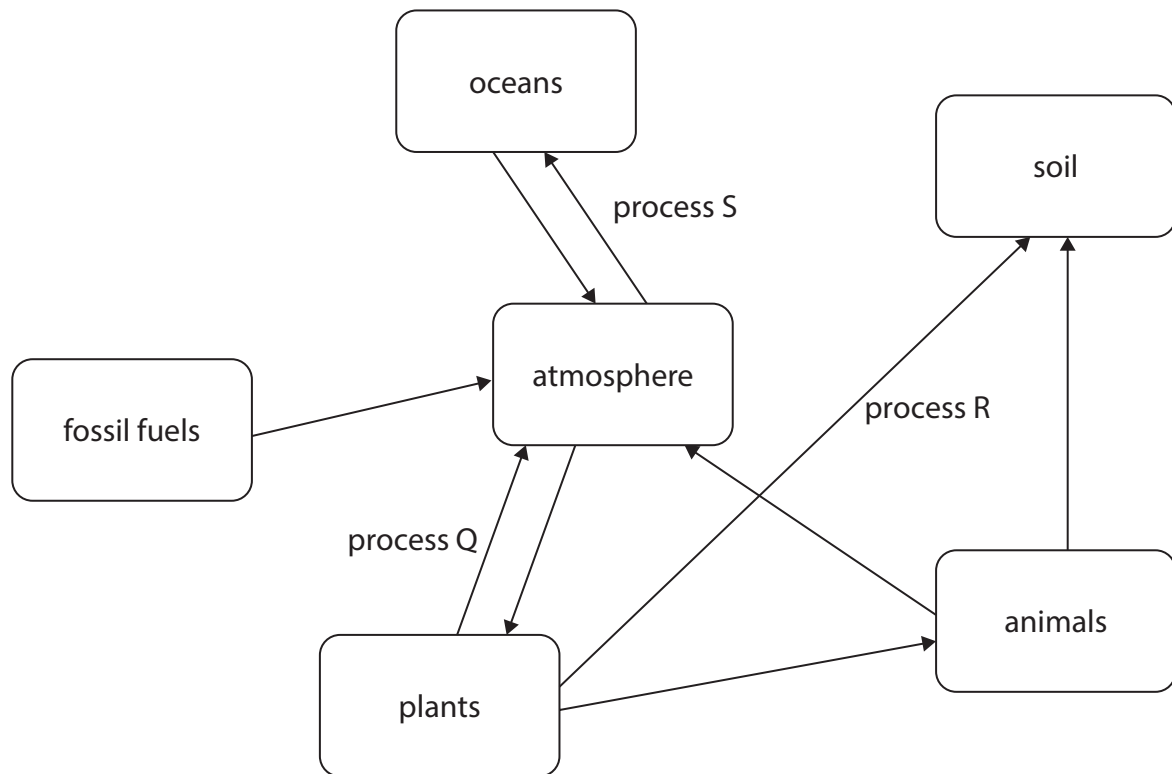



Pearson

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

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

- 1 The diagram shows part of the carbon cycle.



- (a) (i) Which row of the table shows the processes Q and R?

(1)

	Process Q	Process R
A	photosynthesis	decomposition
B	photosynthesis	respiration
C	respiration	decomposition
D	respiration	photosynthesis

(ii) Which is process S?

(1)

- A** active transport
- B** condensation
- C** dissolving
- D** osmosis

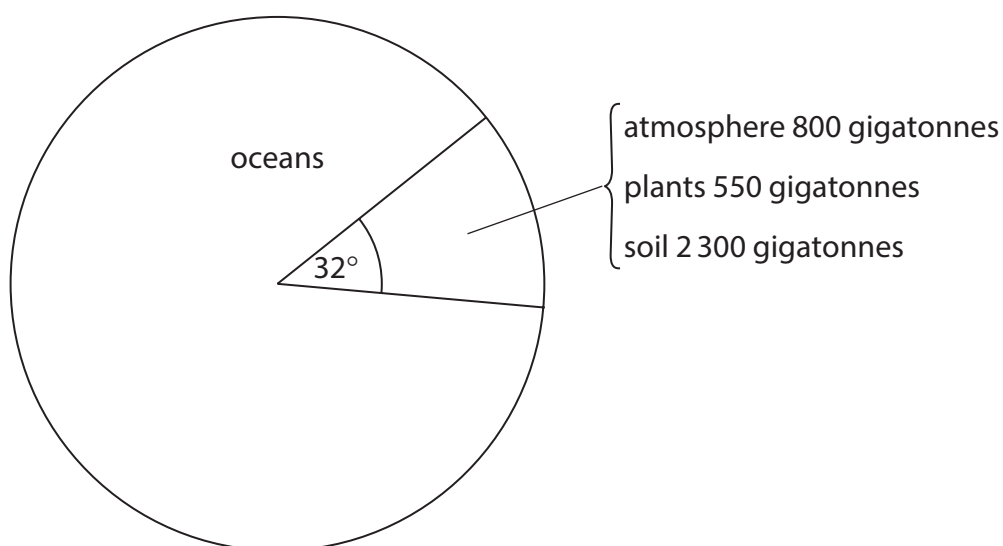
(b) Carbon is stored in the biomass of animals and plants.

Which row of the table shows how carbon is stored in the biomass of animals and plants?

(1)

	Animals	Plants
A	cellulose and glycogen	cellulose
B	glycogen	cellulose and starch
C	glycogen and starch	cellulose and starch
D	starch	glycogen

(c) The pie chart represents the estimated mass of carbon stored in the oceans, atmosphere, plants and soil.

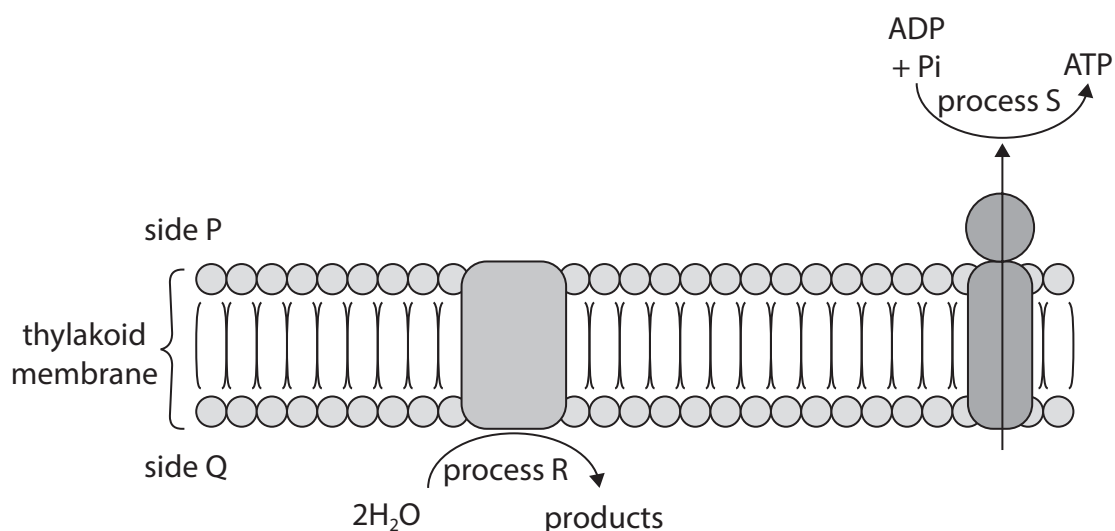


Calculate the estimated mass of carbon stored in the oceans.

(2)

(Total for Question 1 = 5 marks)

- 2 (a) The diagram shows some of the light-dependent reactions of photosynthesis.



- (i) Which row of the table could be used as labels for side P and side Q of this membrane?

(1)

	Side P	Side Q
A	inside the thylakoid	cytoplasm
B	inside the thylakoid	stroma
C	stroma	inside the thylakoid
D	stroma	cytoplasm

- (ii) Name the **three** products of process R shown in the diagram.

(2)

- (iii) The ATP generated by process S can be used in the light-independent reaction.

Name process S.

(1)

(b) The photograph shows part of a Japanese shiso plant.

The leaves of this plant are purple.



(Source: © michael nero jonnes/Alamy)

The purple colour is due to a water-soluble pigment that absorbs green and yellow light.

These leaves also contain chlorophyll.

(i) Describe how the purple pigment in these leaves could be identified.

(4)

(ii) Suggest why it is an advantage to these plants to contain this purple pigment as well as chlorophyll.

(1)

(Total for Question 2 = 9 marks)

3 Logging involves cutting down trees and removing the wood from the forest. This has resulted in a decrease in the area of tropical rainforest in Borneo.

(a) (i) Which term describes environmental changes caused by humans?

(1)

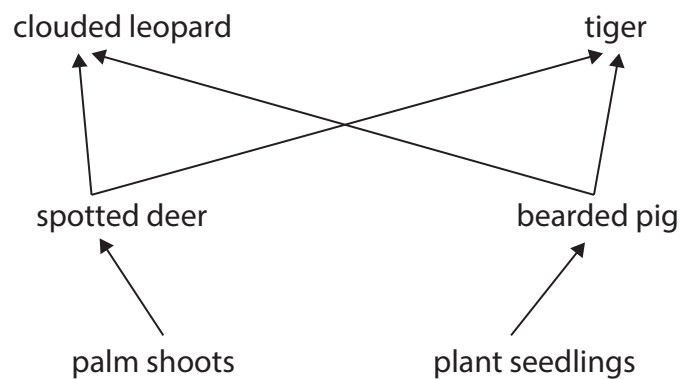
- A** anthropogenic
- B** endemic
- C** forensic
- D** myogenic

(ii) Which is a definition of environment?

(1)

- A** the place where organisms live
- B** the interaction between living organisms in a food web
- C** the climatic conditions such as rainfall and temperature
- D** the physical and biological conditions in a region where organisms live

(b) The diagram shows part of a food web in a tropical rain forest habitat in Borneo.



The photograph shows a bearded pig.



(Source: © stockpexel/Shutterstock)

Describe the niche of the bearded pig in the food web in this tropical forest.

(2)

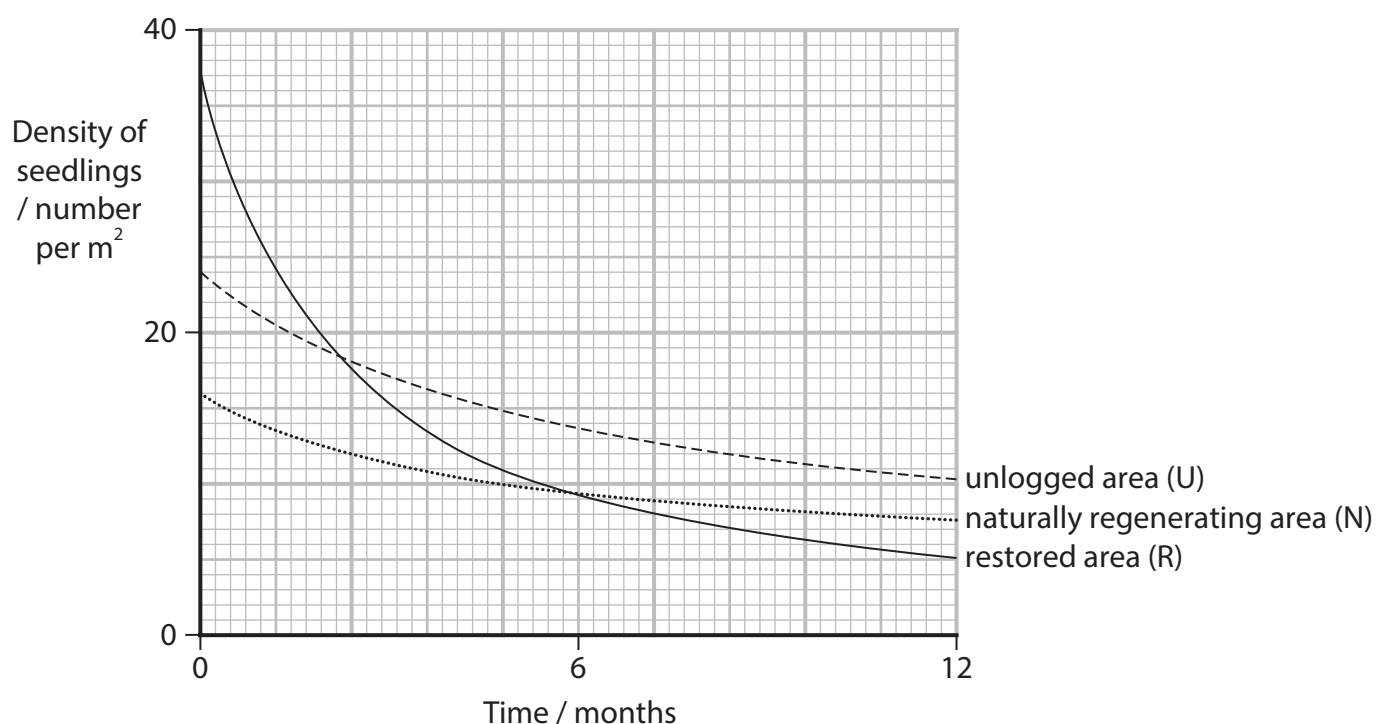
- (c) Restoring areas of tropical forest that have been logged helps maintain biodiversity.

Scientists monitored the density of seedlings in three areas of tropical forest in Borneo:

- unlogged areas (U)
- naturally regenerating logged areas (N)
- restored logged areas (R).

Seeds were released from forest trees still growing in the area.

The graph shows the changes in the density of seedlings in these three areas of tropical forest.



- (i) Calculate the rate of decrease in the number of seedlings in the restored area at 2 months.

Draw a tangent on the graph in the answer book to support your calculation.

Give appropriate units with your answer.

(2)

- (ii) Explain the changes in the density of seedlings in the restored area (R) shown in the graph.

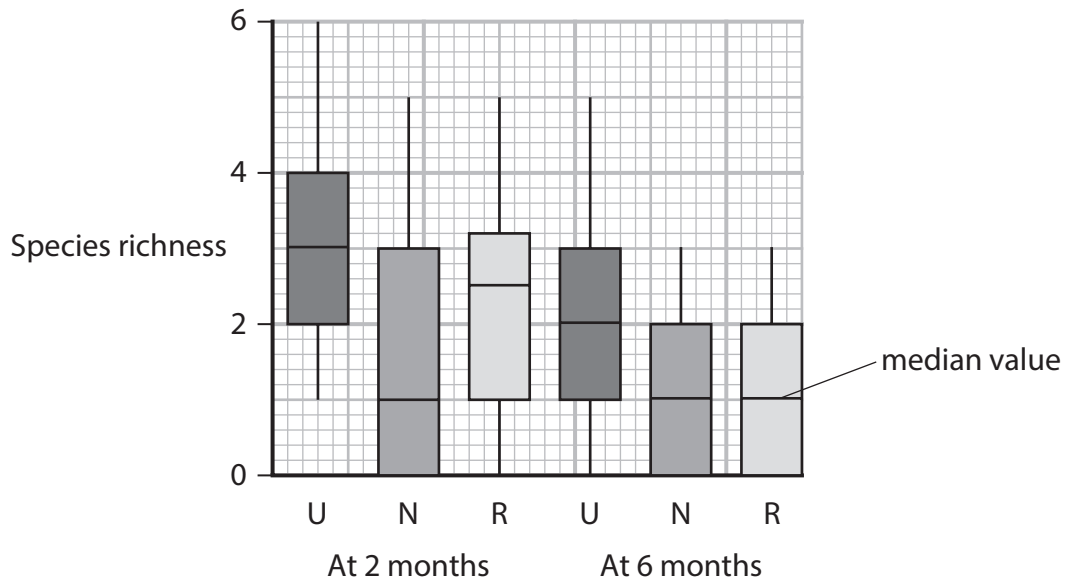
Use the information in the question and your own knowledge.

(3)

- (iii) The scientists determined the species richness of the seedlings in these three areas of tropical forest.

The chart shows the species richness in these three areas in the first six months of this investigation.

The median value is shown in each bar in the chart.



Comment on the results shown in the chart.

(3)

(Total for Question 3 = 12 marks)

- 4 Milk produced by mammals provides nutrients, bioactive peptides and immunity for their newborn babies.

The bioactive peptides in milk can inhibit some pathogens, promote a healthy gut environment, act as antioxidants and have antihypertensive activity.

- (a) (i) Milk contains the disaccharide lactose.

Some people are lactose intolerant and cannot digest the lactose.

Which are the products of digestion of lactose?

(1)

- A fructose and sucrose
- B galactose and fructose
- C glucose and galactose
- D sucrose and glucose

- (ii) Name the type of chemical reaction that breaks down lactose during digestion.

(1)

- (b) Explain why milk provides newborn babies with **passive** immunity.

(3)

*(c) Milk from other mammals is consumed by humans.

Cows provide 81 % of the world's milk whereas camels provide less than 1 %.

Milk from camels may be a suitable alternative to milk from cows.

Camels can be kept in hot dry regions where cattle cannot be kept.

The photograph shows a camel farm in Saudi Arabia.



(Source: © mohd kamarul hafiz/Shutterstock)

The table shows the main components of milk from humans, cows and camels.

Component	Percentage of each component (%) in milk from		
	Humans	Cows	Camels
Water	87 to 88	85 to 87	87 to 90
Lipid	3.0 to 5.0	3.8 to 5.5	1.2 to 4.5
Protein	0.8 to 1.0	2.9 to 3.5	2.15 to 4.90
Lactose	6.9 to 7.2	4.7 to 4.9	3.5 to 4.5

Discuss the advantages and disadvantages for humans of consuming milk from cows and camels.

Use the information in the table and the rest of the question to support your answer.

(6)

(Total for Question 4 = 11 marks)

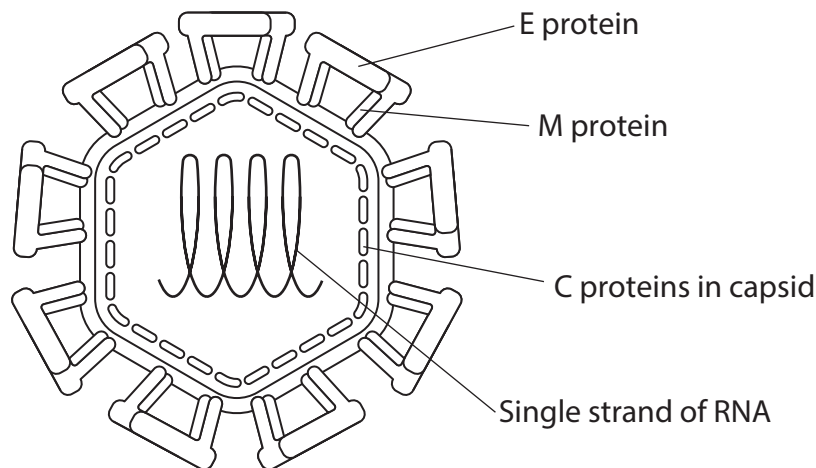
- 5 Mosquitoes are responsible for transmitting some types of pathogens, including the Zika virus that causes Zika fever.

When a mosquito bites a person, the viruses carried by the mosquito are transmitted into the blood stream of that person.

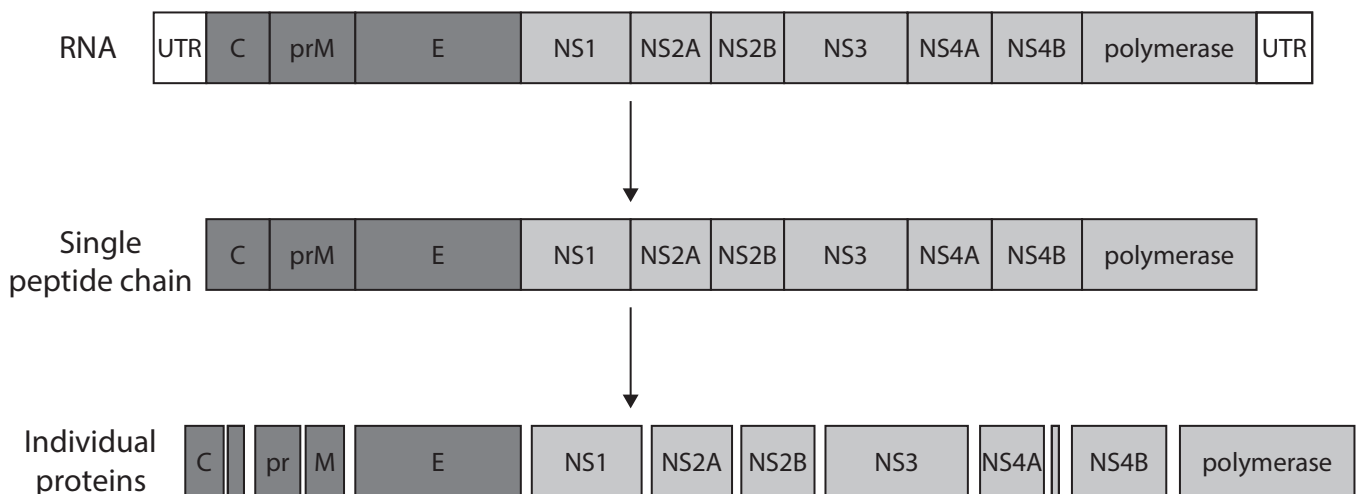
*(a) Zika virus has an envelope.

The diagrams show part of the structure of a Zika virus and translation of its RNA genome.

Structure of a Zika virus



Translation of the RNA



Key

□ untranslated regions ■ structural proteins ■ other proteins

Deduce how Zika viruses infect their host cells and produce more viruses in the lytic cycle.

Use the information in the question, the diagrams and your own knowledge to support your answer.

(6)

- (b) Male mosquitoes can hear the wings of female mosquitoes beating.

In one study, scientists mutated a gene responsible for hearing in male mosquitoes.

They then put normal female mosquitoes in with either normal males, heterozygous males or homozygous males.

- (i) The table shows the number of attempts to mate in 5 minutes.

Male mosquito genotypes	normal	heterozygous	homozygous for the mutation
Number of attempts to mate in 5 minutes	6.3 ± 2.7	6.9 ± 2.7	none

Explain the results of this investigation.

(2)

- (ii) The percentage of females that were fertilised was determined.

A high percentage of females were fertilised by the normal males and the heterozygous males. No females were fertilised by the homozygous mutated males.

The scientists determined the number of sperm in the three genotypes of males.

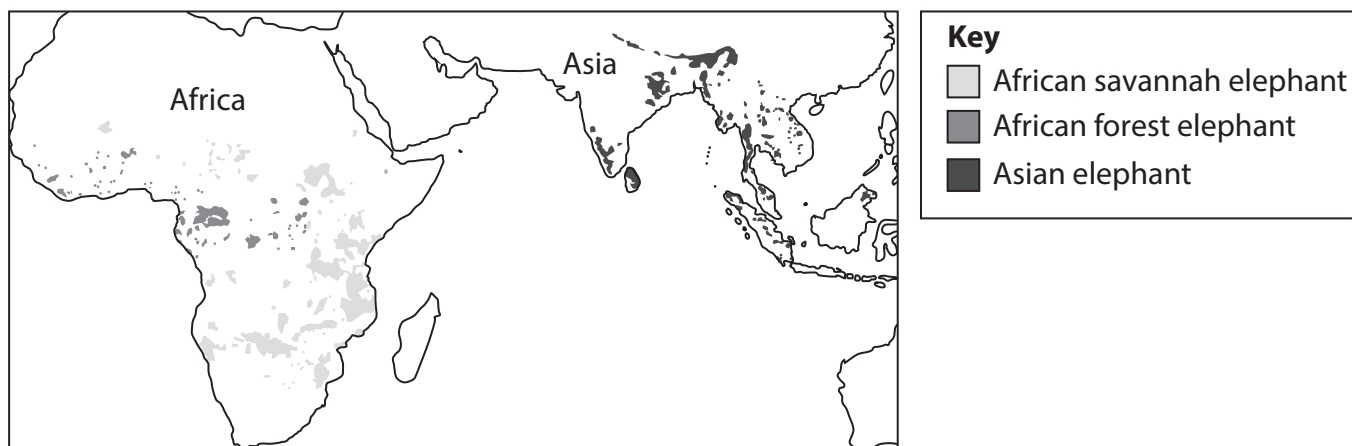
Suggest why the numbers of sperm in these three groups of males was determined.

(2)

(Total for Question 5 = 10 marks)

- 6 There are three modern-day species of elephant: Asian elephant, African savannah elephant and African forest elephant.

The map shows the distribution of these elephants.

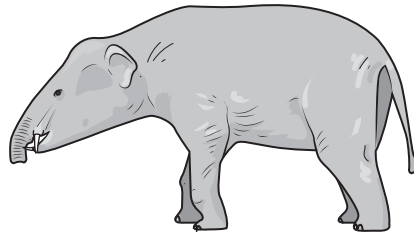


The photographs show African savannah elephants.



- (a) Elephants evolved from palaeomastodons.

The diagram shows what a palaeomastodon could have looked like.



Explain how modern-day elephants' trunks evolved from these ancestors.

Use the information in the photographs and the diagram to support your answer.

(3)

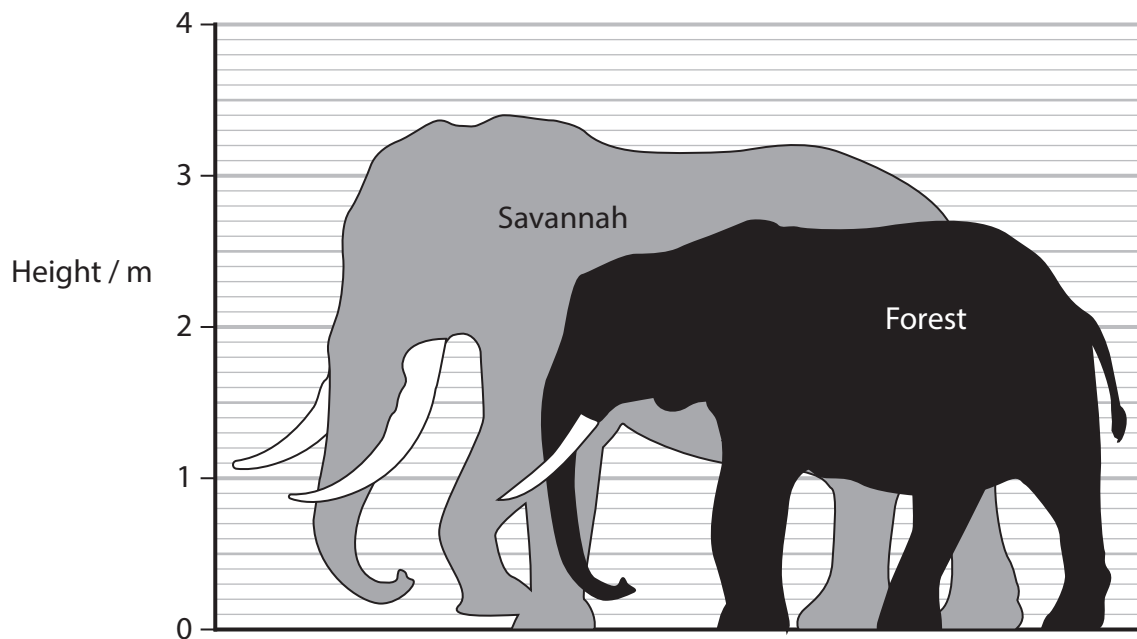
- (b) Asia and Africa used to be joined together as one continent called Gondwana.

The three modern-day species of elephant evolved from a common ancestor that lived in Gondwana.

Explain how the Asian elephant evolved to become a different species than the African elephants.

(3)

- (c) The diagram shows a comparison of the heights of an African savannah elephant and an African forest elephant.



- (i) How many times taller is the savannah elephant than the forest elephant?

Measure the highest point on each elephant.

(1)

- A** 1.18
- B** 1.19
- C** 1.25
- D** 1.26

- (ii) Suggest how climate change could have contributed to the evolution of these two species of African elephant.

(3)

- (iii) Describe how a breeding experiment could provide evidence that these African elephants are two different species.

(2)

(Total for Question 6 = 12 marks)

- 7 Cystic fibrosis (CF) is a recessive genetic disorder that results from the expression of a mutation in the gene coding for the CFTR protein.

There are more than 2 000 known mutations in this gene that can result in CF. Many of these mutations are very rare.

- (a) Delta F508 (DF508) mutation is the most common mutation. It is caused by the deletion of three base pairs.

- (i) In 2022, 105 352 people were diagnosed with CF.

Approximately 66 % of these people had the DF508 mutation.

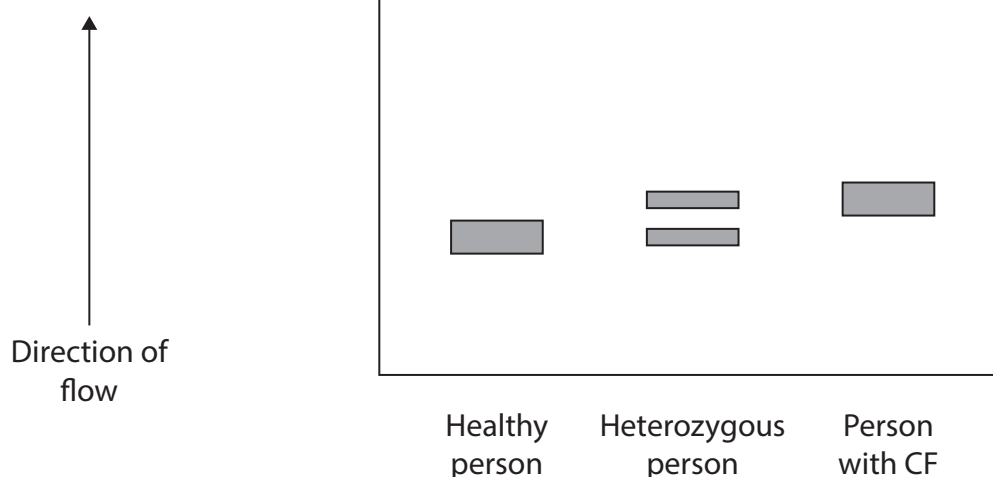
Calculate the number of people who had CF due to this mutation.

(1)

- (ii) Gel electrophoresis can be used to identify the DF508 mutation.

The diagram shows the position of the bands produced by gel electrophoresis of the DNA from:

- a healthy person
- a heterozygous (carrier) person
- a person who has CF due to this mutation.



Explain the differences in the banding patterns produced from the DNA of these three people.

(4)

(b) A treatment is being developed that can be inhaled by people who have CF.

This treatment contains viruses that have the normal CFTR gene inside them.

Inhalation of this treatment will result in a normal copy of the CFTR gene being inserted into the DNA of the cells lining the patient's airway.

(i) Explain **two** considerations that had to be made when choosing the virus to use in this treatment.

(3)

(ii) Explain how this treatment should help improve gas exchange in people with CF.

(3)

(iii) People with CF often have problems digesting their food properly.

Explain why this treatment will **not** improve the digestion of a person with CF.

(2)

(iv) Explain why this treatment will **not** prevent CF from being inherited.

(2)

(Total for Question 7 = 15 marks)



- 8** People with diabetes are more susceptible to infection than people without diabetes.

This is due, in part, to non-functional phagocytes and high concentrations of glucose in the blood.

The chance of the evolution of antibiotic-resistant bacteria in a person with diabetes is high.

- (a) There are approximately 530 million people in the world with diabetes.

This number is projected to increase to 1.3 billion (1.3×10^9) by 2050.

Calculate how many more people could have diabetes by 2050.

Give your answer in standard form.

(1)

- (b) (i) Explain why non-functional phagocytes make a person more susceptible to infection by bacteria.

(2)

- (ii) Suggest why a high concentration of glucose in the blood makes a person more susceptible to infection by bacteria.

(2)

- (iii) As a result, people with diabetes are frequently prescribed antibiotics.

Explain why bacteria are more likely to become antibiotic-resistant in a person with diabetes.

(3)

- (c) Scientists have investigated the emergence of resistance to the antibiotic rifampicin in mice without diabetes and mice with diabetes.

Mice were infected with the bacteria *S. aureus* and divided into four groups.

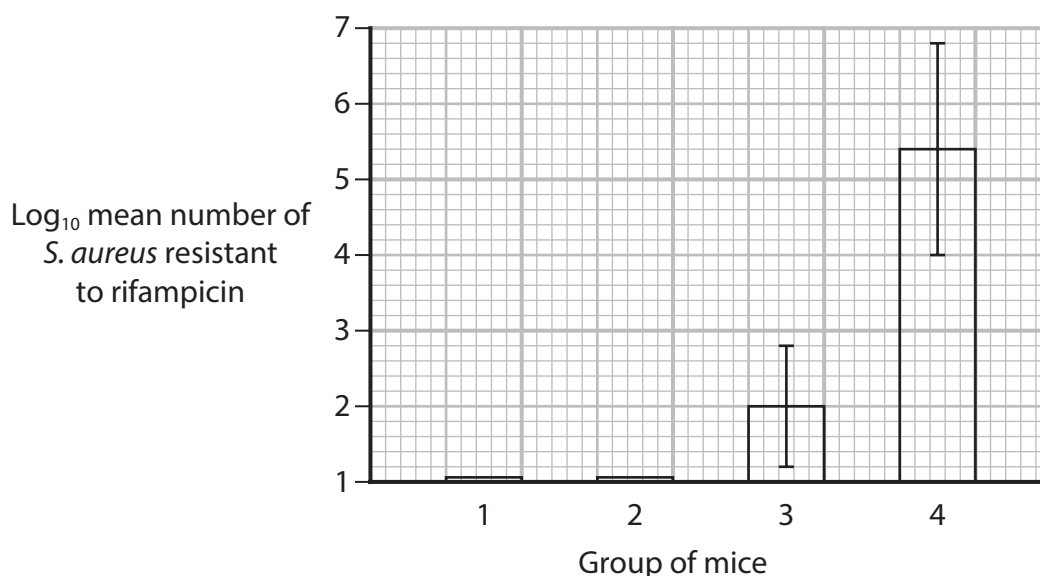
The table shows details of the four groups of mice.

Group of mice	Without or with diabetes	Treated or not treated with rifampicin
1	without	not treated
2	without	treated
3	with	not treated
4	with	treated

After five days, a sample of *S. aureus* was collected from each mouse and their resistance to rifampicin determined.

The graph shows the mean number of *S. aureus* bacteria resistant to rifampicin per mouse in each group.

The mean number is converted to $\log_{10}$.



- (i) Describe how **dilution plating** can be used to determine the mean number of *S. aureus* resistant to rifampicin.

(3)

- (ii) Calculate the difference in the mean number of *S. aureus* resistant to rifampicin between group 3 and group 4.

Give your answer as a whole number.

(2)

- (iii) Discuss the extent to which these results support the claim that bacteria are more likely to become antibiotic-resistant in a person with diabetes.

(3)

(Total for Question 8 = 16 marks)

TOTAL FOR PAPER = 90 MARKS



Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

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Afternoon (Time: 1 hour 45 minutes)

Paper reference **WBI14/01A**

Biology

International Advanced Level

UNIT 4: Energy, Environment, Microbiology and Immunity

Answer Book

You must have:

Question Paper (sent separately)

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

Question 1

1 (a) (i)

(1)

☐ A

☐ B

☐ C

☐ D

1 (a) (ii)

(1)

☐ A

☐ B

☐ C

☐ D

1 (b)

(1)

☐ A

☐ B

☐ C

☐ D



1 (c)

(2)

Answer

(Total for Question 1 = 5 marks)

Question 2

2 (a) (i)

(1)

☐ A

☐ B

☐ C

☐ D

2 (a) (ii)

1

2

3

(2)



2 (a) (iii)

(1)

2 (b) (i)

(4)

2 (b) (ii)

(1)

(Total for Question 2 = 9 marks)



Question 3**3** (a) (i)

(1)

☐ **A**☐ **B**☐ **C**☐ **D****3** (a) (ii)

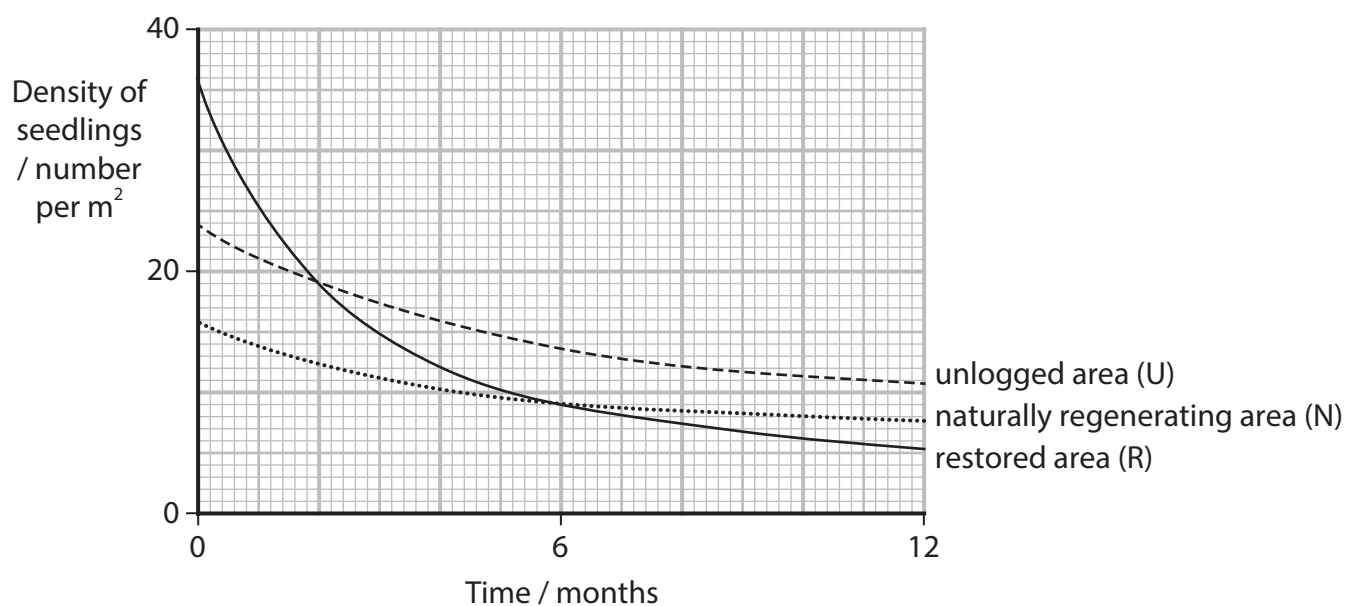
(1)

☐ **A**☐ **B**☐ **C**☐ **D****3** (b)

(2)



3 (c)



3 (c) (i)

(2)

Answer

3 (c) (ii)

(3)



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3 (c) (iii)

(3)

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(Total for Question 3 = 12 marks)



Question 4**4** (a) (i)

(1)

☐ **A**☐ **B**☐ **C**☐ **D****4** (a) (ii)

(1)

4 (b)

(3)



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***4** (c)

(6)

(Total for Question 4 = 11 marks)



Question 5

*5 (a)

(6)

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(Total for Question 5 = 10 marks)



Question 6

6 (a)

(3)

6 (b)

(3)

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6 (c) (i)

(1)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

6 (c) (ii)

(3)

6 (c) (iii)

(2)

(Total for Question 6 = 12 marks)



Question 7**7** (a) (i)

(1)

Answer

7 (a) (ii)

(4)

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7 (b) (i)

(3)

7 (b) (ii)

(3)



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7 (b)(iii)

(2)

7 (b)(iv)

(2)

(Total for Question 7 = 15 marks)



Question 8**8** (a)

(1)

Answer

8 (b) (i)

(2)

8 (b) (ii)

(2)



8 (b)(iii)

(3)

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8 (c) (i)

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8 (c) (ii)

(2)

Answer

8 (c) (iii)

(3)

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(Total for Question 8 = 16 marks)

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