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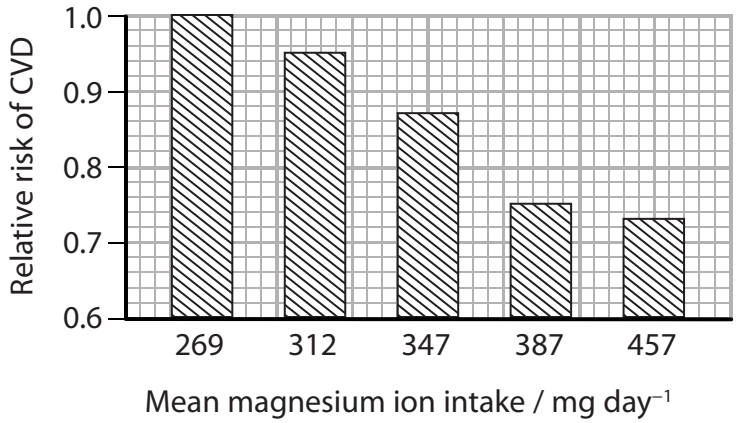
Erratum Notice

9BN0/01
Pearson Edexcel GCE Biology
Paper 1: The Natural Environment and Species Survival
Thursday 7th June 2018 - Morning
Question 1(a)

Please be advised that the graph in question 1(a) has been printed incorrectly on the question paper.

A replacement graph is provided below. Please cross through the graph printed on page 2 of the question paper and use this replacement graph to answer questions 1(a)(i) and 1(a)(ii).

Please select your answer to these questions in the question paper booklet.



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P52288EA



Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Biology A (Salters Nuffield)

Advanced

Paper 1: The Natural Environment and Species Survival

Thursday 7 June 2018 – Morning
Time: 2 hours

Paper Reference
9BN0/01

You must have:
Calculator, HB pencil, ruler

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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You may use a scientific calculator.
- 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.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

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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1/1/1/1/

P 5 2 2 8 8 A 0 1 3 6

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Answer ALL questions.

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 ☒.

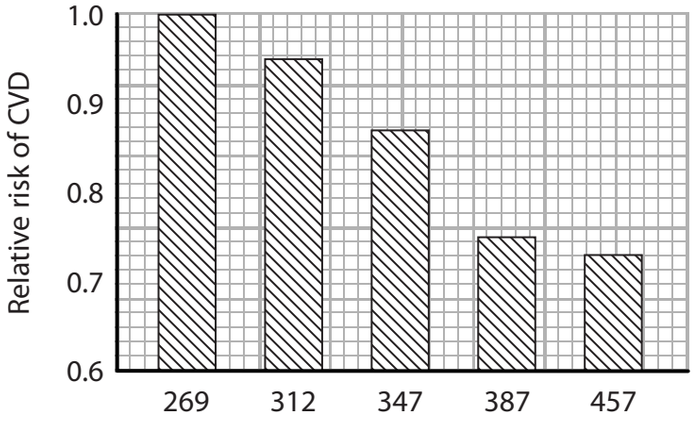
1 Cardiovascular disease (CVD) is a major cause of death and disability in the UK.

(a) The relationship between magnesium ions in the diet and CVD has been studied.

In one study, magnesium ions were added to the diets of a group of men.
The effect of this on the relative risk of CVD was recorded.

The mean normal dietary intake of magnesium ions is 269 mg day^{-1}.

The results of the study are shown in the graph.



(i) Which of the following statements can be made about the relationship between an increased magnesium ion intake and the risk of CVD in this study?

(1)

An increased magnesium ion intake

☒ **A** causes an increase in CVD

☒ **B** causes a reduction in CVD

☒ **C** is correlated with an increase in CVD

☒ **D** is correlated with a reduction in CVD

(ii) What is the daily increase in magnesium ion intake that reduces the relative risk of CVD by 0.13?

(1)

☒ **A** 43 mg day^{-1}

☒ **B** 78 mg day^{-1}

☒ **C** 118 mg day^{-1}

☒ **D** 347 mg day^{-1}

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(b) It has been suggested that magnesium ions are involved in regulating the ratio of HDL to LDL in the blood.

(i) Describe the role of LDLs in the development of atherosclerosis.

(3)

(ii) Explain how atherosclerosis can result in damage to heart muscle.

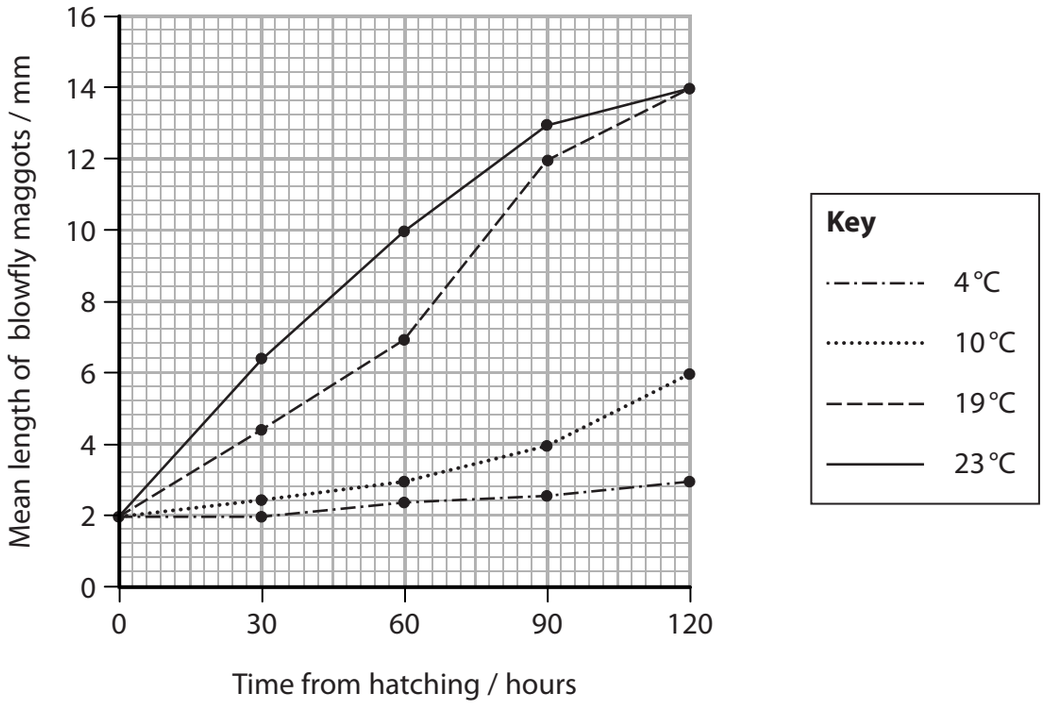
(3)

(Total for Question 1 = 8 marks)

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2 One method of estimating the time of death is to determine the age of blowfly maggots on a dead body.

(a) The effect of environmental temperature on the growth of blowfly maggots is shown in the graph.



(i) Blowfly maggots found on a dead body had lengths between 3 and 8 mm.
The body had been at a constant environmental temperature of 19 °C since death.

Determine the maximum time since these maggots hatched.

(1)

..... hours

(ii) Determine the fastest rate of growth of a blowfly maggot at a temperature of 19 °C.

Give your answer to 2 significant figures.

(2)

..... mm hour^{-1}

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(iii) Explain the effect of temperature on the rate of growth of blowfly maggots.

(3)

(b) Microorganisms are also found on a dead body.

Describe the role of decomposers, such as microorganisms, in the carbon cycle.

(2)

(Total for Question 2 = 8 marks)

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3 A newborn baby can respond to infections.

(a) The mother of a baby will produce an immune response to any infections that she acquires.

Antibodies providing specific immunity to these infections are found in the milk produced by the mother.

(i) Which cell produces antibodies?

(1)

☒ **A** macrophage

☒ **B** plasma cell

☒ **C** red blood cell

☒ **D** T cell

(ii) The type of immunity that the newborn baby obtains from the milk produced by its mother is

(1)

☒ **A** artificial active immunity

☒ **B** artificial passive immunity

☒ **C** natural active immunity

☒ **D** natural passive immunity

(b) Inflammation is a non-specific response to an infection.

Explain how changes in the blood vessels result in the redness and swelling seen at the site of inflammation.

(4)

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(c) Interferon is involved in the response to viral infections.

(i) The influenza virus can be lethal to mice.

The effects of interferon on influenza infection in mice was investigated.

Mice were infected with influenza virus and then given interferon.

The results of the investigation are shown in the table.

Interferon dose / units per mouse	Median survival time / days
No dose	3.3
8×10^3	4.4
8×10^4	8.5
8×10^5	>42

Explain these results.

(3)

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(ii) Interferon can be used to treat people with viral hepatitis.

Interferon can be made by animal cells or by genetically modified bacteria.

The table shows information about interferon made by these animal cells and genetically modified bacteria.

Source of interferon	Type of molecule	Folding	Antiviral activity
Animal cells	Glycoprotein	Correctly folded	High
Genetically modified bacteria	Protein	Incorrectly folded and needs to be refolded before it can be used	Low

Explain why the interferon made by genetically modified bacteria is different from the interferon made by animal cells.

(2)

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(iii) Glycoproteins made in animal cells are released into the extracellular fluid by

(1)

☒ **A** endocytosis

☒ **B** exocytosis

☒ **C** facilitated diffusion

☒ **D** phagocytosis

(Total for Question 3 = 12 marks)

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4 Leptin is a protein hormone with a role in the control of appetite in humans.

(a) The leptin gene is located on chromosome 17.

(i) State what is meant by the term gene.

(2)

(ii) Describe the role of tRNA in the production of leptin.

(3)

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(iii) Describe how the primary structure of leptin enables it to be soluble in water.

(3)

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(b) Several mutations of the leptin gene have been identified. All these mutations are frameshift mutations that result in shortened primary structures.

A frameshift mutation involves the insertion or removal of one or two nucleotides from a gene.

Describe how a frameshift mutation could result in the production of leptin with a variety of shorter primary structures.

(2)

(Total for Question 4 = 10 marks)

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5 Cigarette smoking is associated with several medical problems.

In an investigation, some female mice were exposed to cigarette smoke during pregnancy.

The ability of their male offspring to produce sperm and the activity of the sperm were investigated.

The results of this investigation are shown in the table.

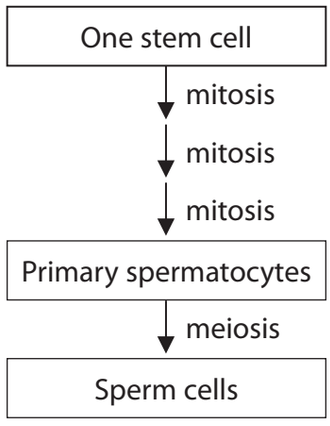
Group	Percentage of sperm that are motile (%)	Ability of sperm to cross the zona pellucida of an egg cell	Percentage of stem cells producing sperm in the testes (%)
Offspring of control mice	68	Good	100
Offspring of mice exposed to cigarette smoke	45	Poor	40

(a) Analyse the data to explain why exposing pregnant mice to cigarette smoke affects the fertility of their male offspring.

(3)

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(b) Sperm are produced from stem cells in a process that involves several cycles of mitosis and a single cycle of meiosis, as shown in the diagram.



(i) State what is meant by the term stem cell.

(2)

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(ii) Compare and contrast the results of mitosis and meiosis in the production of sperm cells from stem cells.

(4)

(Total for Question 5 = 9 marks)

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6 Tuberculosis (TB) is an infectious disease caused by mycobacteria.

(a) Most cases of TB are caused by infection with *Mycobacterium tuberculosis* (*M. tuberculosis*).

The ribosomes of bacteria are

(1)

☒ **A** larger than the ribosomes in eukaryotes

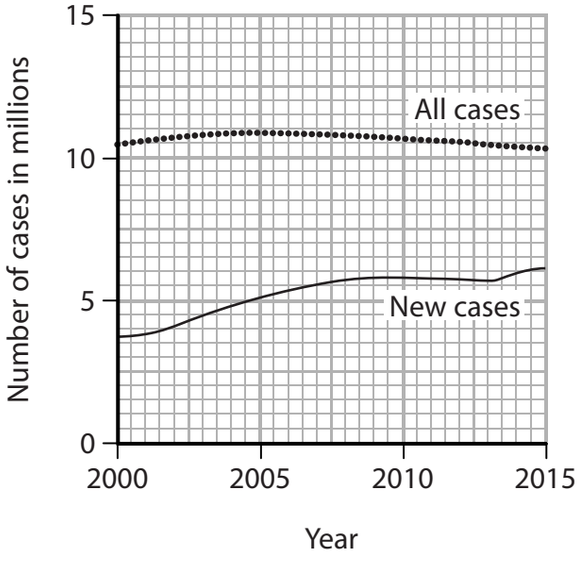
☒ **B** smaller than ribosomes in eukaryotes

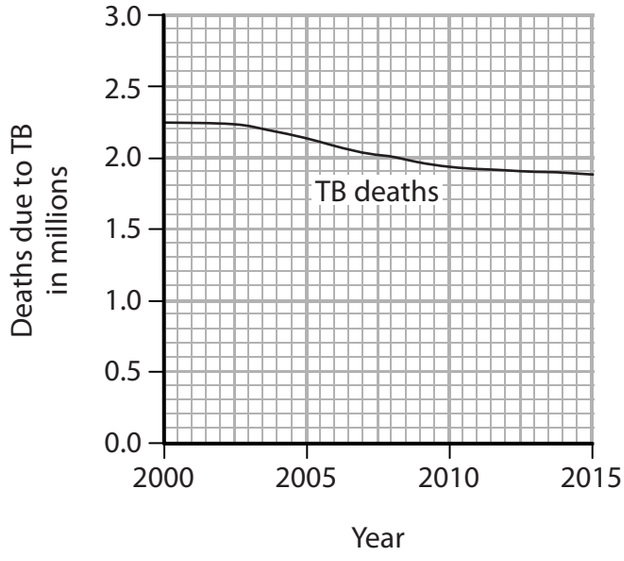
☒ **C** the same size as ribosomes in animal cells

☒ **D** the same size as ribosomes in plant cells

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(b) The graphs show the number of cases of TB and the number of deaths from TB worldwide from 2000 to 2015.





In 1993 the World Health Organisation (WHO) declared TB a global public health emergency. Since then, there has been a programme to reduce the impact of this disease.

Analyse the data to deduce the effectiveness of this programme.

(3)

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*(c) Individuals infected with *M. tuberculosis* can be treated with antibiotics.

Four of the antibiotics used to treat TB are shown in the table.

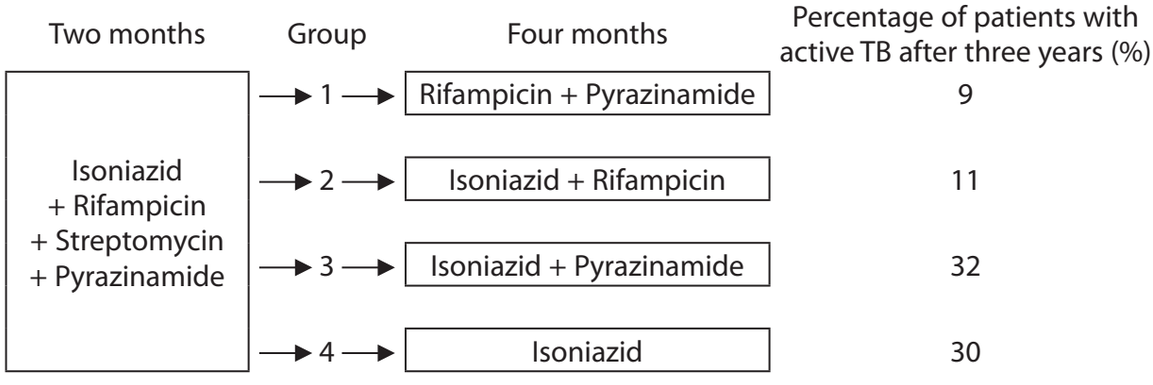
Antibiotic	Mechanism of action
Isoniazid	Inhibits the synthesis of a fatty acid needed to make bacterial cell walls
Rifampicin	Inhibits bacterial RNA polymerase
Streptomycin	Binds to bacterial ribosomes to prevent the binding of tRNA
Pyrazinamide	Not yet known, but not the same mechanisms as the other three antibiotics

In one clinical trial lasting six months, the effect of treating TB with these antibiotics was investigated.

All patients were treated with all four antibiotics for two months. Then they were treated with different pairs of antibiotics or isoniazid alone for a further four months.

All patients were free of any signs of active TB at the end of the clinical trial.

The design of the trial and the percentage of these patients with TB three years after the trial ended are shown in the diagram.



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Analyse the data to comment on the effectiveness of these antibiotics for the treatment of TB.

(6)

(Total for Question 6 = 10 marks)

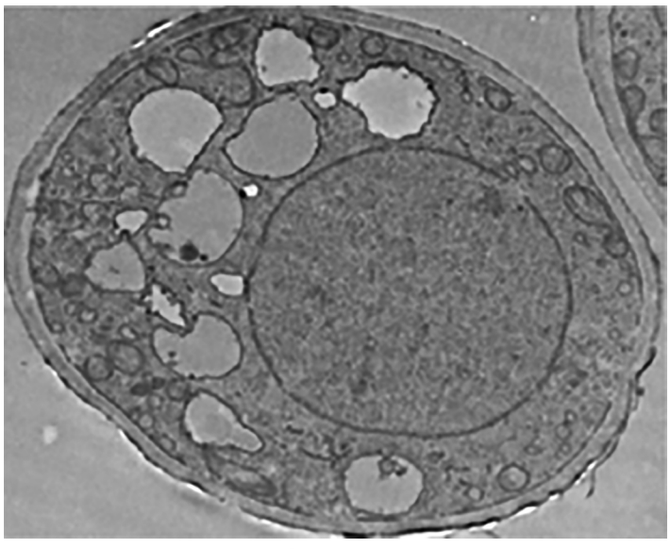
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7 *Hymenoscyphus fraxineus* (*H. fraxineus*) is the fungus that causes ash dieback. This disease usually kills all the ash trees that it infects.

(a) The electron micrograph shows a section through a fungal cell.



Magnification ×1000

To which group do fungi belong?

(1)

☒ **A** Archaea

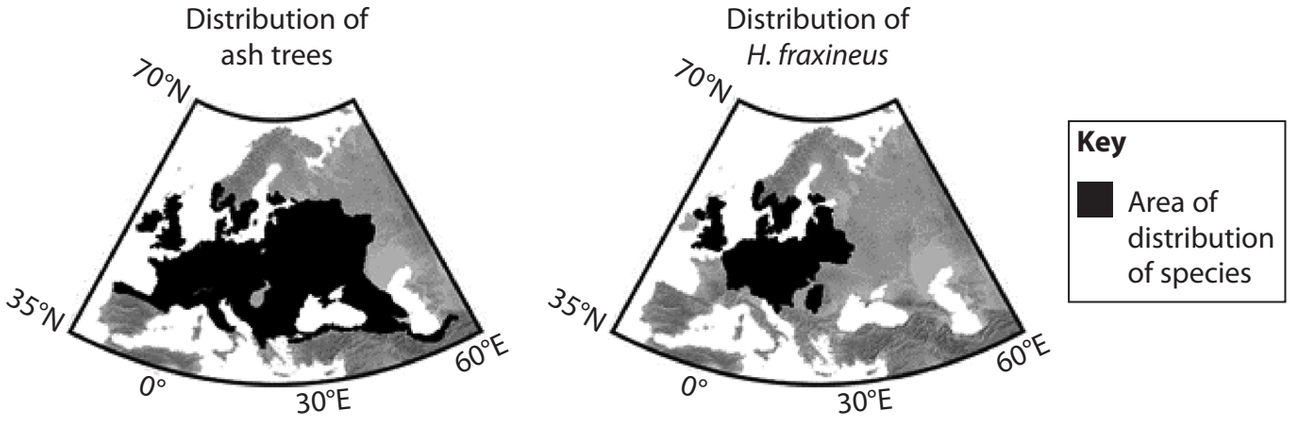
☒ **B** Eukaryota

☒ **C** Prokaryota

☒ **D** Viruses

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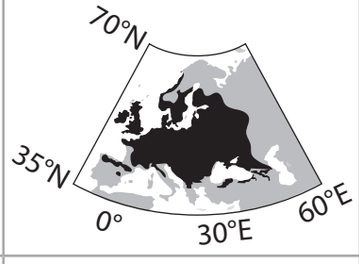
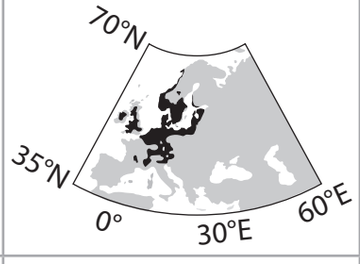
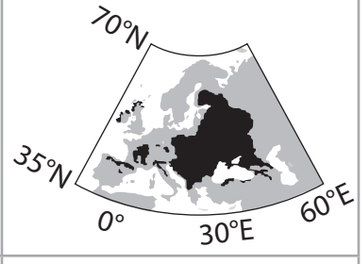
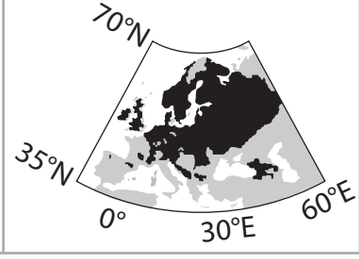
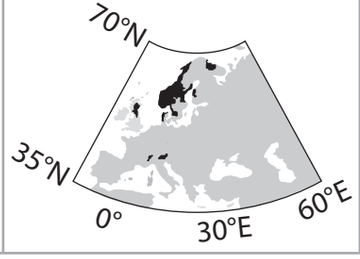
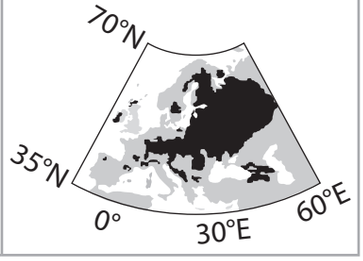
(b) The diagrams show the distribution of ash trees and *H. fraxineus* in 2007.



In 2007 the mean atmospheric carbon dioxide concentration was 398 ppm.

Models have been used to predict the effect of increasing atmospheric carbon dioxide concentration on the distribution of ash trees and *H. fraxineus*.

The table shows these predictions.

Concentration CO_2 / ppm	Predicted region suitable for ash trees	Predicted region suitable for *H. fraxineus*	Predicted distribution of ash trees
430			
1080			

(i) Which of the following is an abiotic factor that should be considered in the model?

(1)

☒ **A** ash tree resistance to *H. fraxineus*

☒ **B** *H. fraxineus* pathogens

☒ **C** humidity

☒ **D** ocean pH

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(ii) Which of the following could be caused by an increase in atmospheric carbon dioxide from 398 ppm to 1080 ppm?

(1)

☒ **A** decreased photosynthesis

☒ **B** global warming

☒ **C** increased plant respiration

☒ **D** ozone depletion

(iii) Analyse the data to explain the predicted effect of climate change on the distribution of ash trees.

(5)

(Total for Question 7 = 8 marks)

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8 Trypsin is an enzyme found in many groups of living organisms.

Trypsin specifically acts on a polypeptide to form amino acids.

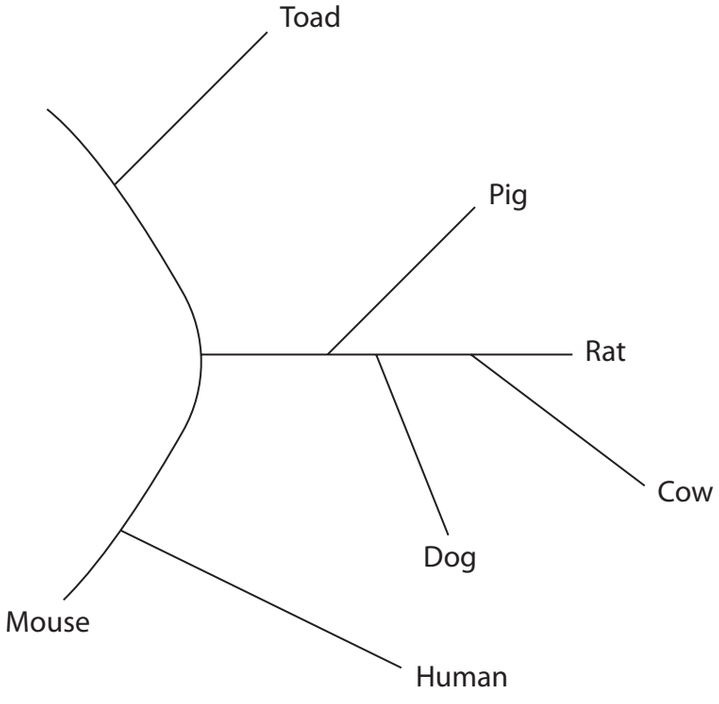
(a) State the type of chemical reaction catalysed by trypsin.

(1)

.....

(b) The primary structures of trypsin molecules from different species have been used to produce a phylogenetic tree for trypsin.

Each branch of the following phylogenetic diagram represents trypsin from a different species.



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Explain how the primary structure of trypsin molecules can be used to produce a phylogenetic tree.

(3)

(c) Trypsin molecules from vertebrates, but not other animals, have a calcium ion binding site.

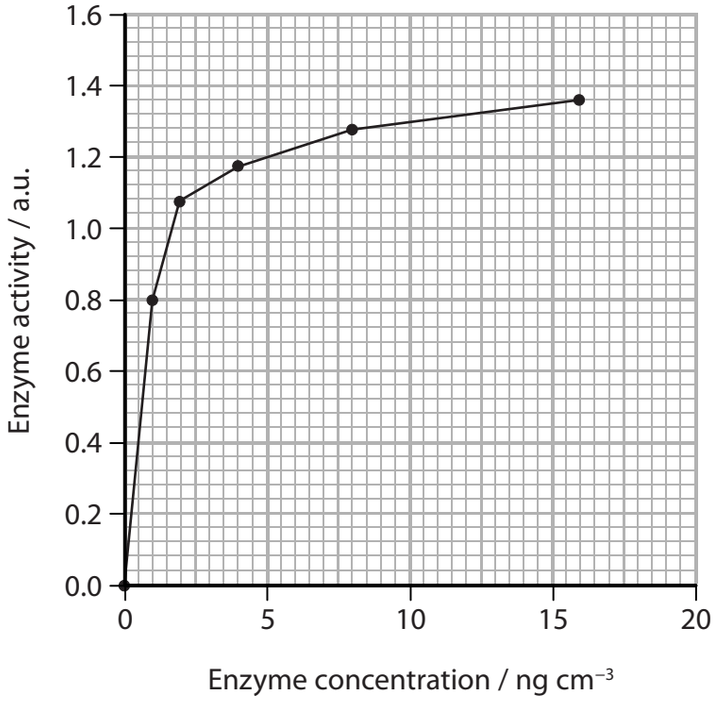
Explain how this calcium ion binding site could have evolved in vertebrates.

(3)

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(d) In an experiment, the effect of enzyme concentration on the activity of human trypsin was measured.

The results are shown in the graph.



Explain which range of enzyme concentrations should be used to compare the activity of trypsin from different species.

(2)

(Total for Question 8 = 9 marks)

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9 Tropical rainforests play a role in maintaining biodiversity and in storing carbon.

(a) In a mature tropical rainforest, there is no net increase in biomass.

(i) Which statement describes the role of photosynthesis in the carbon cycle?

(1)

☒ **A** carbon dioxide is oxidised to form organic molecules

☒ **B** carbon dioxide is reduced to form organic molecules

☒ **C** organic molecules are combusted to produce carbon dioxide

☒ **D** organic molecules are decomposed to release carbon dioxide

(ii) The gross primary productivity (GPP) for one mature tropical rainforest was found to be 24 800 kJ m^{-2} $year^{-1}$. It was estimated that 65% of GPP was used in respiration.

Calculate the energy transferred to the next trophic level.

(2)

..... kJ m^{-2} $year^{-1}$

(b) Explain how reforestation of tropical rainforests can be used to minimise climate change.

(3)

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(c) Information on biodiversity has been collected from various rainforest habitats in Madagascar.

(i) Describe what needs to be measured in order to compare the biodiversity of two rainforests.

(2)

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(ii) The biodiversity of the land area of Earth has been estimated.

The table shows information on the number of species of plants and vertebrate animals in the rainforests of Madagascar and for the land area of Earth.

Region	Plants		Vertebrate animals		Land area / km^2
	Number of known species	Number of known endemic species	Number of known species	Number of known endemic species	
Madagascar	12 000	9704	987	771	59 300
Land area of the Earth	300 000	300 000	27 300	27 300	149 000 000

Analyse the data to determine the importance of the rainforests of Madagascar in maintaining biodiversity on Earth.

(3)

(Total for Question 9 = 11 marks)

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10 Photosynthesis is a process that occurs in all green plants.

The electron micrograph shows part of a chloroplast in a plant cell.



(a) (i) The labelled starch grain in the chloroplast is 2.2 μm long.

Calculate the width of this chloroplast between T and U.

(2)

..... μm

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(ii) Explain the relationship between the structure and functions of a granum in photosynthesis.

(3)

(b) Describe how starch is formed from the products of the light-independent reactions of photosynthesis.

(4)

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*(c) Herbicides kill weeds by affecting their growth.

The effect of herbicides on the production of starch in the leaves of *Echinochloa crus-galli* (barnyard grass) has been investigated.

The table shows the results for four herbicides: Diuron, Propanil, Linuron and Swep.

Concentration of herbicide / µg cm^{-3}	Relative percentage of starch produced (%)			
	Diuron	Propanil	Linuron	Swep
0.0	100	100	100	100
0.1	0	50	50	100
1.0	0	0	0	50
10.0	0	0	0	0
100.0	0	0	0	0

It is thought that these herbicides act on the light-dependent reactions of photosynthesis.

Devise an investigation that would produce quantitative data on the effectiveness of the herbicides on the light-dependent reactions of photosynthesis.

(6)

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(Total for Question 10 = 15 marks)

TOTAL FOR PAPER = 100 MARKS

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