

Write your name here

Surname

Other names

**Pearson**  
**Edexcel GCE**

Centre Number

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Candidate Number

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# Biology

**Advanced**

**Unit 4: The Natural Environment and Species Survival**

Monday 12 June 2017 – Afternoon

**Time: 1 hour 30 minutes**

Paper Reference

**6BI04/01**

**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.
- 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.*
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

## Advice

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

Turn over ►

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Pearson

**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** Chloroplasts and mitochondria are both found in plant cells.

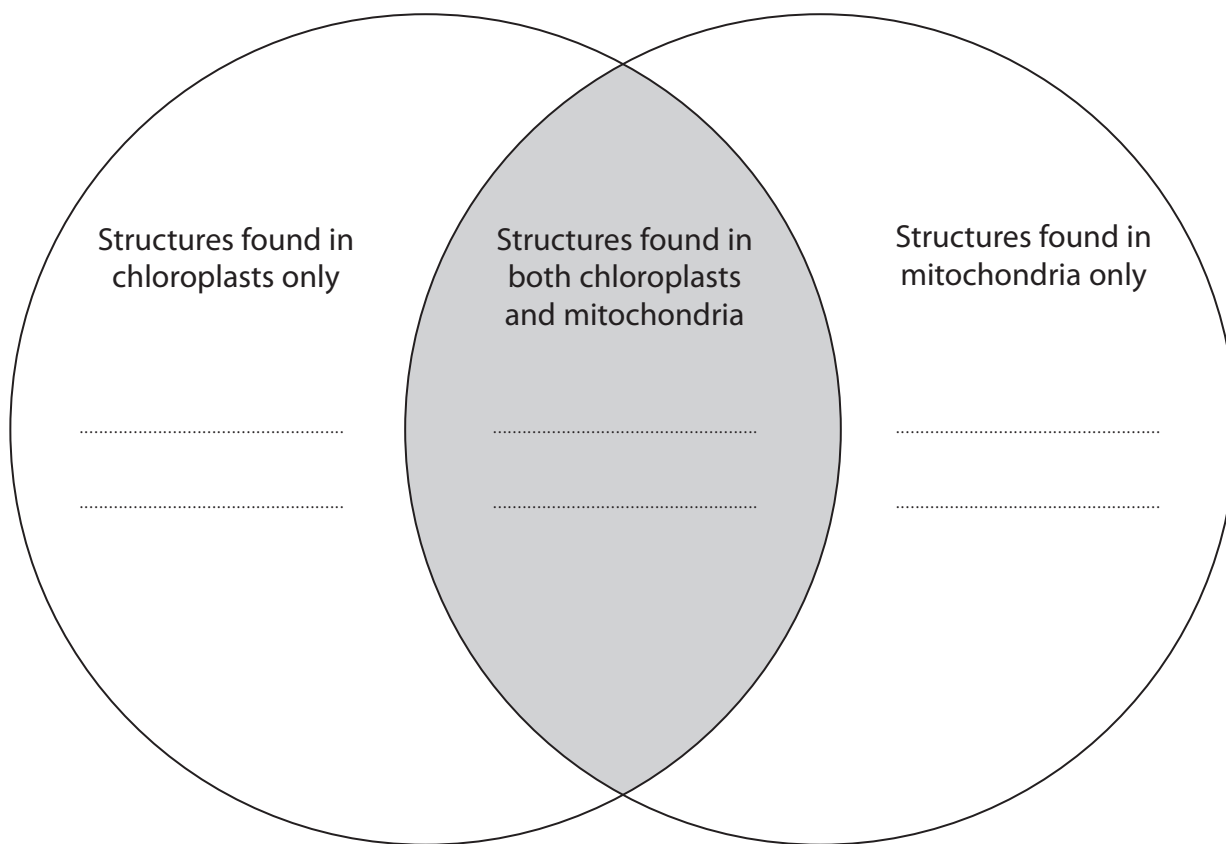
(a) The structures found in chloroplasts and mitochondria can be studied using an electron microscope.

Some structures are found in both chloroplasts and mitochondria.  
Other structures are found in either chloroplasts only or mitochondria only.

A Venn diagram can be drawn to represent this information. Structures found in both chloroplasts and mitochondria are written in the part of the diagram where the circles overlap.

Complete the Venn diagram below by writing the names of **two** structures in each part of the diagram.

(3)



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(b) The chloroplast is involved in photosynthesis. Both the light-dependent and the light-independent reaction take place in the chloroplast.

Some of the products of these reactions are used by plants to synthesise lipids, such as triglycerides.

(i) Describe the structure of a triglyceride.

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(ii) Put a cross  in the box next to the chemical reaction that is involved in the synthesis of a triglyceride.

(1)

- A** condensation
- B** hydrolysis
- C** oxidation
- D** reduction



(iii) Explain how the products of both the light-dependent and the light-independent reactions are used to synthesise triglycerides.

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**(Total for Question 1 = 11 marks)**

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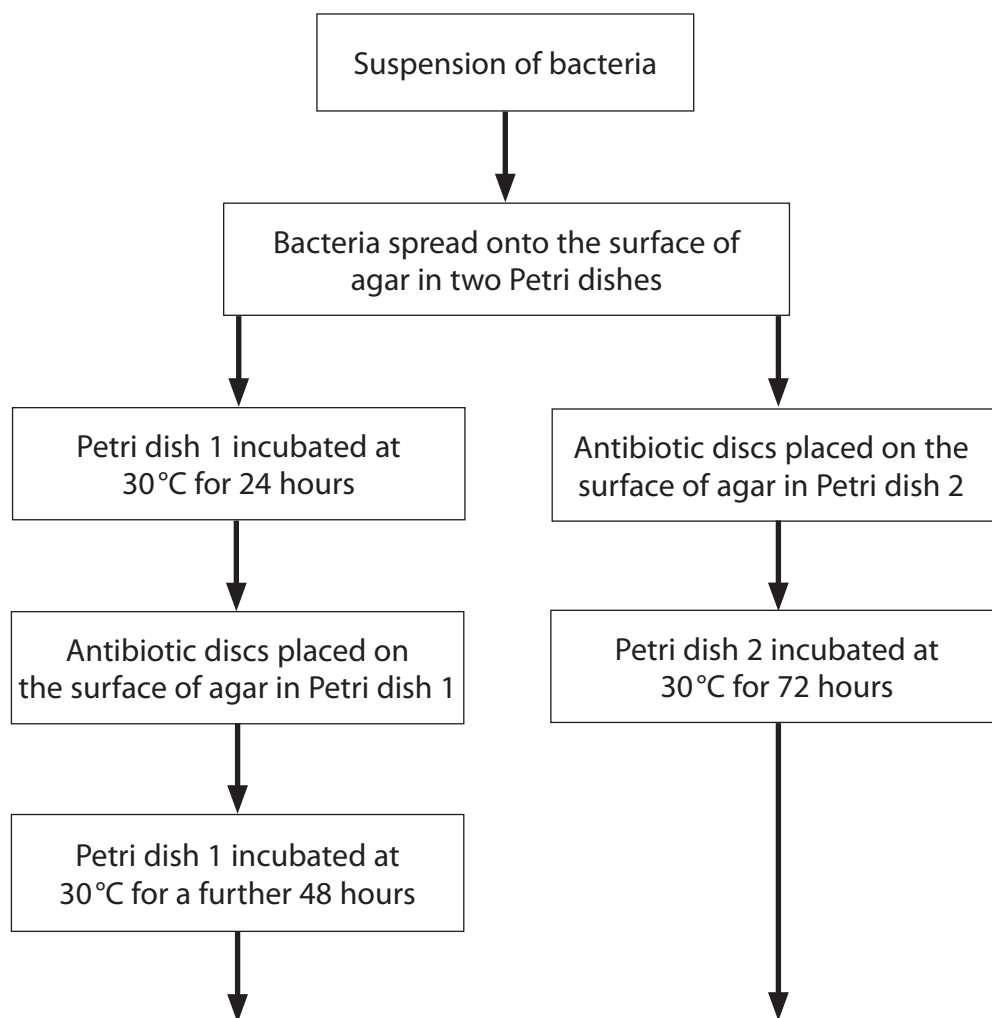
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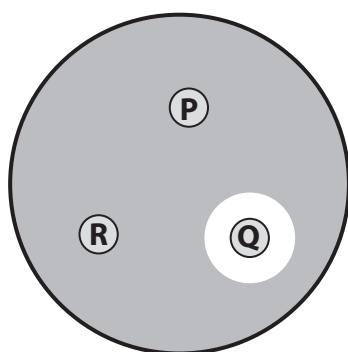
2 The effect of three different antibiotics, **P**, **Q** and **R**, on one strain of bacteria, was investigated.

Small discs of filter paper were each soaked in a different antibiotic and dried. These discs were used in this investigation.

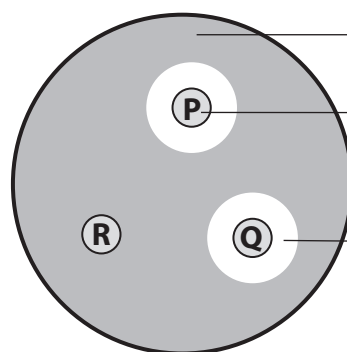
The flow chart below shows the procedures used in this investigation.



Appearance of Petri dish 1 after 72 hours



Appearance of Petri dish 2 after 72 hours



bacteria growing on surface of agar  
disc soaked in antibiotic  
clear zone where no bacteria are present



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(a) Explain why the Petri dishes were incubated at 30°C.

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(b) Explain why there are more risks involved in the procedures used for Petri dish 1 than the procedures used for Petri dish 2.

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(c) Explain the results of this investigation.

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**(Total for Question 2 = 7 marks)**



3 Invertebrates are animals without a backbone.

A number of species of small invertebrates can be found living in freshwater streams.

The presence of particular species of invertebrates in a stream can indicate the levels of pollution in that stream. Polluted water has a low oxygen content.

The table below shows the different qualities of water in a stream and the species of invertebrates present.

Quality of water	Species of invertebrates present
clean with no pollution	mayfly nymph stonefly nymph
low pollution	caddis fly larva freshwater shrimp
medium pollution	hoglouse blood worm
high pollution	tubifex worm rat-tailed maggot

(a) Each species of invertebrate has its own niche.

Put a cross ☒ in the box next to the description of a niche.

(1)

- A The distribution and abundance of a species in a habitat.
- B The location of a species within its habitat.
- C The role of a species in an ecosystem.
- D The trophic level of a species.

(b) Describe how the minimum level of oxygen that each invertebrate can tolerate in a stream could be determined.

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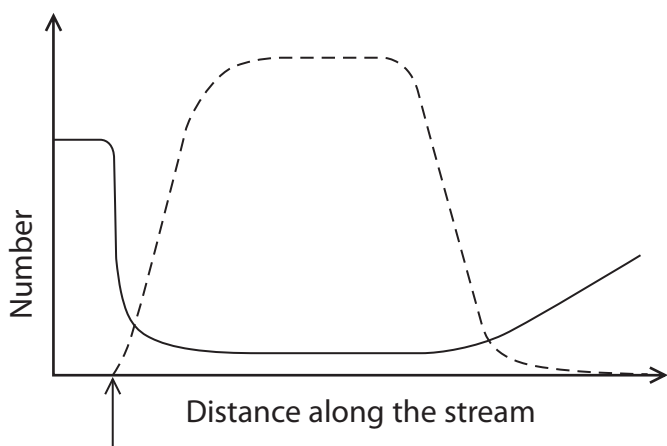
(c) A student studied a stream above and below a point where highly polluted water was washed into the stream.

The student took samples of water from this stream.

The student recorded the number of different species of invertebrates present in each sample. The student also recorded the total number of one of the species of invertebrates in each sample.

Only the invertebrates listed in the table were studied.

The graph below shows the results of this study.



**Key**

— number of different species of invertebrates

- - - the number of one of the species of invertebrates

pollution washed into the stream

(i) Put a cross ☒ in the box next to the term that completes the following sentence.

The student recorded the number of species present in the samples in order to measure (1)

- A endemism
- B genetic diversity
- C species richness
- D taxonomy

(ii) Put a cross ☒ in the box next to the species that was the most abundant up to the point where the polluted water was washed into the stream. (1)

- A blood worm
- B freshwater shrimp
- C mayfly nymph
- D tubifex worm



(iii) Suggest why not all of the eight species listed in the table are found in the clean water.

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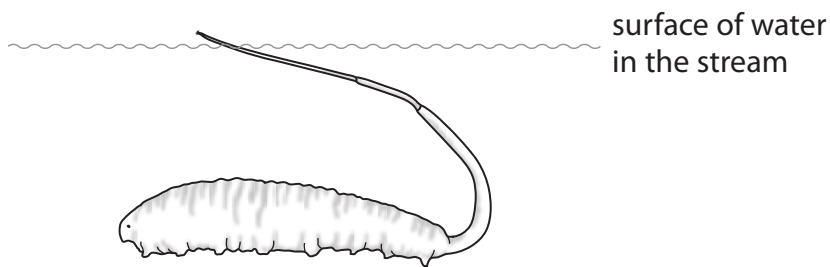
(iv) The graph shows the total number of one of the species of invertebrates.

Put a cross  in the box next to the name of this species.

(1)

- A** caddis fly larva
- B** hoglouse
- C** stonefly nymph
- D** tubifex worm

(d) The diagram below shows a rat-tailed maggot.



(i) Suggest why this invertebrate can survive in highly polluted water.

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(ii) With reference to the diagram, suggest the type of adaptation to the environment shown by this organism.

Give a reason for your answer.

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**(Total for Question 3 = 13 marks)**

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4 The evolution of a species results from a change in allele frequency in a population of organisms.

Grey squirrels were introduced into Britain in the 1870s.

Recently, more and more black squirrels have been seen. The black squirrels have a genetic mutation that stops their fur turning grey.

The black squirrels can breed with the grey squirrels.

The photograph below shows a black squirrel.



Magnification  $\times 0.25$

- (a) The allele frequency for fur colour in black squirrels can be calculated if the number of each type of squirrel is known.

There have been 6100 sightings of the black squirrel.

Grey squirrels are homozygous recessive (**bb**). The population of black squirrels contains 25% that are homozygous dominant (**BB**).

- (i) Calculate the number of heterozygous (**Bb**) squirrels in the black squirrel population. (1)

Answer .....

- (ii) Calculate the frequency of the recessive allele (**b**) in the black squirrel population. (2)

Answer .....



(b) Scientists think that black squirrels might be more immune to disease than grey squirrels.

Suggest how the frequency for the grey allele (**b**) could change in the future.

Give reasons for your answer.

(4)

**(Total for Question 4 = 7 marks)**



5 In 2015, there was a very large increase in the number of birth defects in babies whose mothers were infected by the Zika virus during pregnancy.

(a) In 2016, scientists began the development of a vaccine that contained antigens from the Zika virus.

\*(i) Suggest how a vaccine against the Zika virus would work.

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(ii) Put a cross ☒ in the box next to the immunity that individuals given this vaccine would develop.

(1)

- A artificial active
- B artificial passive
- C natural active
- D natural passive

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(iii) Describe the tests that would need to be carried out before the Zika vaccine could be used to prevent birth defects caused by this virus.

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(b) The Zika virus is an enveloped RNA virus.

There are two strains of this virus, one in Africa and one in Asia. The virus in Brazil has been shown to be most closely related to the Asian strain.

Explain how scientists have shown that the Zika virus in Brazil is more closely related to the Asian strain.

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6 A wound is an injury to living tissue.

(a) In an open wound, the skin is cut or broken. Skin flora may be found in open wounds.

Suggest why the presence of skin flora in a wound may be an advantage.

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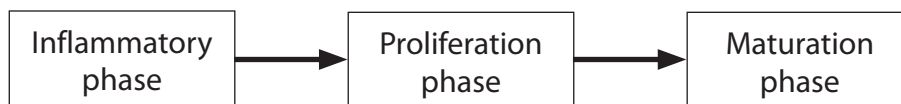
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(b) The healing of a wound takes place in three phases.

The diagram below shows these phases.



(i) Explain the appearance of a wound during the inflammatory phase.

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(ii) During the proliferation phase, skin cells undergo mitosis.

Explain the role of mitosis in the healing of a wound.

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(iii) The maturation phase involves collagen. Collagen is a fibrous protein.

Describe the structure of a fibrous protein.

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(c) Chronic wounds develop if the wound does not heal properly. These wounds may become contaminated with bacteria.

Ulcers are chronic wounds. The table below shows the types of bacteria found in four different types of ulcer.

Type of ulcer	Percentage of ulcers contaminated with each type of bacterium (%)		
	<i>Pseudomonas</i>	<i>E.coli</i>	<i>S.aureus</i>
Diabetic	45	15	15
Neuropathic	22	22	0
Pressure	20	10	20
Traumatic	40	7	0

(i) Use the information in the table to give three conclusions about the types of bacteria that contaminate ulcers.

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(ii) Suggest the problems doctors face in prescribing antibiotics for ulcers.

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7 Dendrochronology can be used as evidence for global warming.

(a) State the meaning of the term **global warming**.

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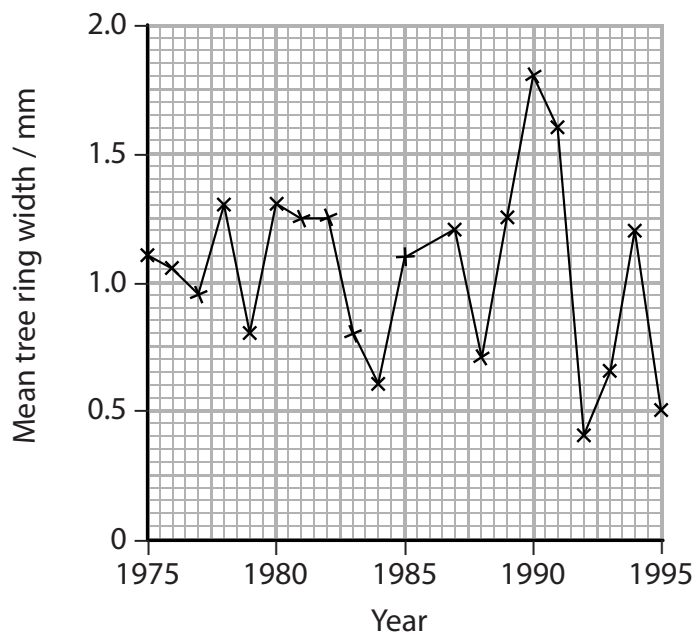
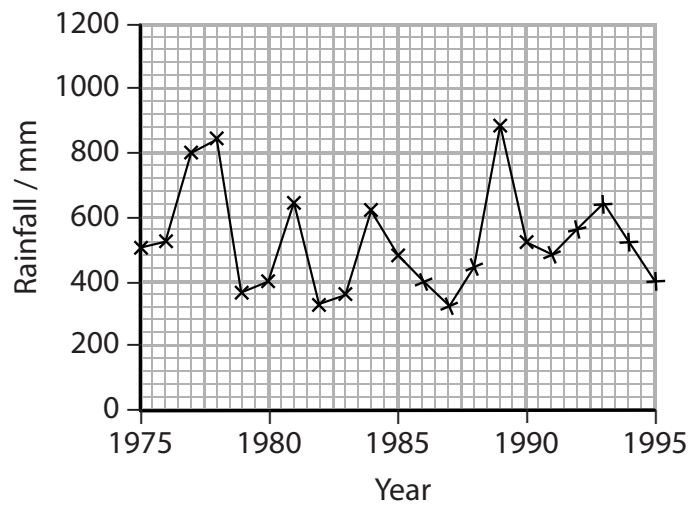
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(b) From 1975 to 1995, a study in part of Africa looked at the pattern of rainfall in the area and the mean tree ring width.

The graphs below show the results of this study.



(i) Comment on the extent to which these results indicate that there is a correlation between rainfall and tree ring width.

(2)

(ii) Explain why rainfall could affect the tree ring width.

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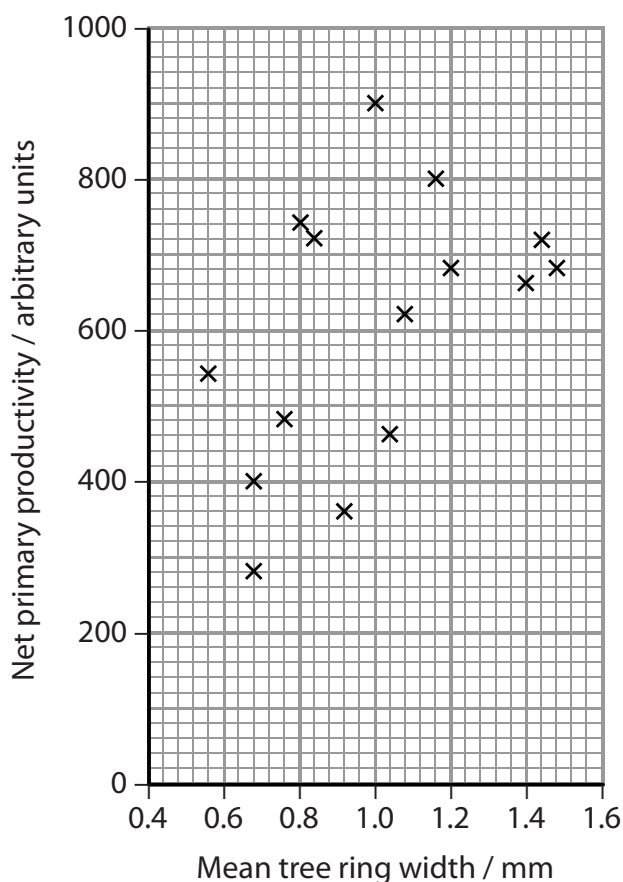
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(c) Another study looked at the net primary productivity (NPP) in the area and the mean tree ring width.

The graph below shows the results of this study.



(i) Put a cross  in the box next to the units for NPP that could replace the arbitrary units on the graph.

(1)

- A**  $\text{kJ cm}^{-1} \text{yr}^{-1}$
- B**  $\text{kJ cm}^{-1} \text{yr}^{-1}$
- C**  $\text{kJ cm}^{-2} \text{yr}^{-1}$
- D**  $\text{kJ cm}^{-2} \text{yr}^{-1}$



(ii) Explain the difference between NPP and gross primary productivity (GPP).

(2)

(iii) Suggest reasons for the variability of the results shown in the graph.

(3)

**(Total for Question 7 = 13 marks)**

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8 A compost heap contains decomposing plant material.

\*(a) Explain how plant material is changed during decomposition in a compost heap.

(6)

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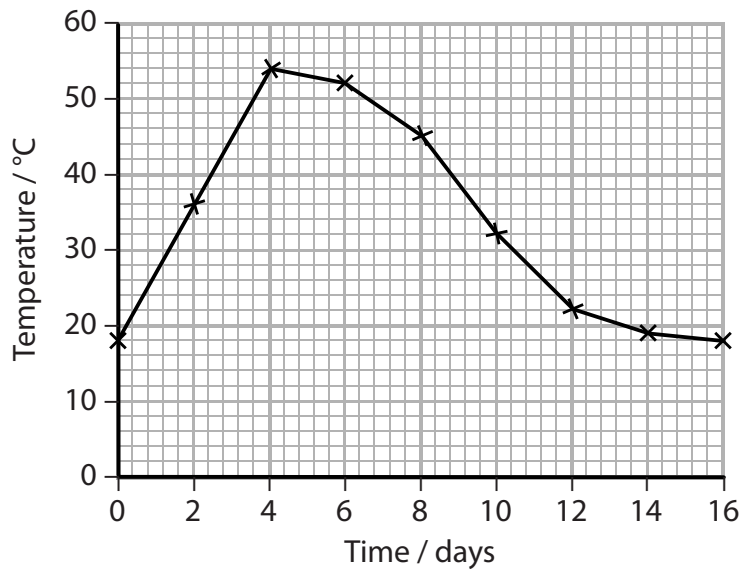
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(b) The graph below shows the temperature in a compost heap over a period of 16 days.



(i) Explain the changes in temperature in this compost heap.

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(ii) A body was found buried in a compost heap.

Suggest how conditions in the compost heap would have affected the decomposition of this body.

(5)

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**(Total for Question 8 = 13 marks)**

**TOTAL FOR PAPER = 90 MARKS**

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