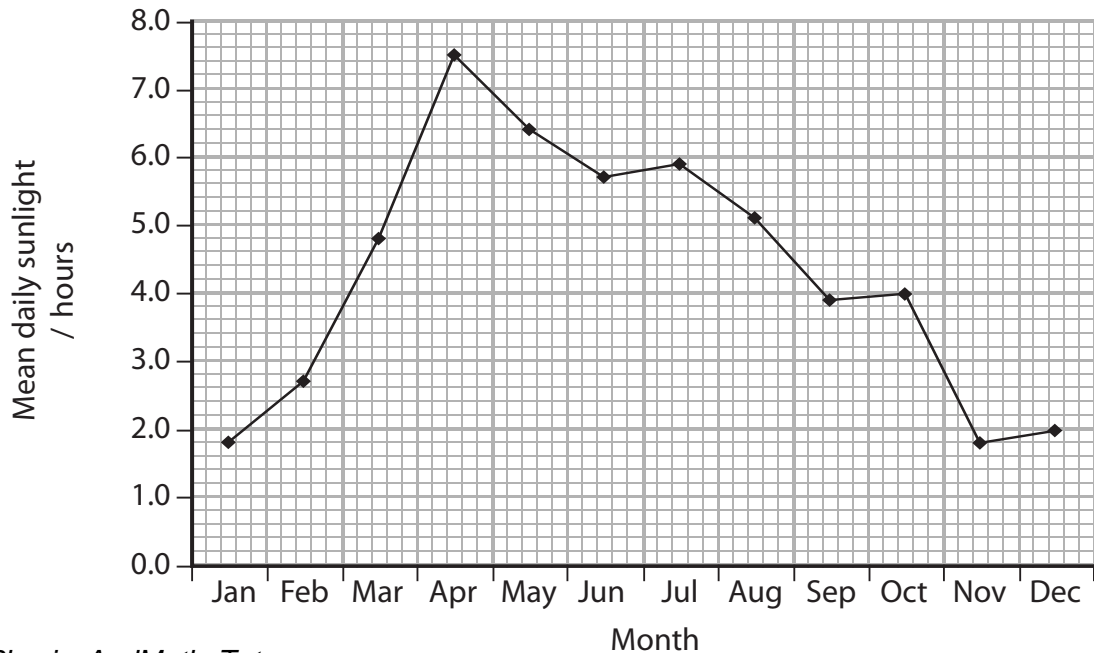
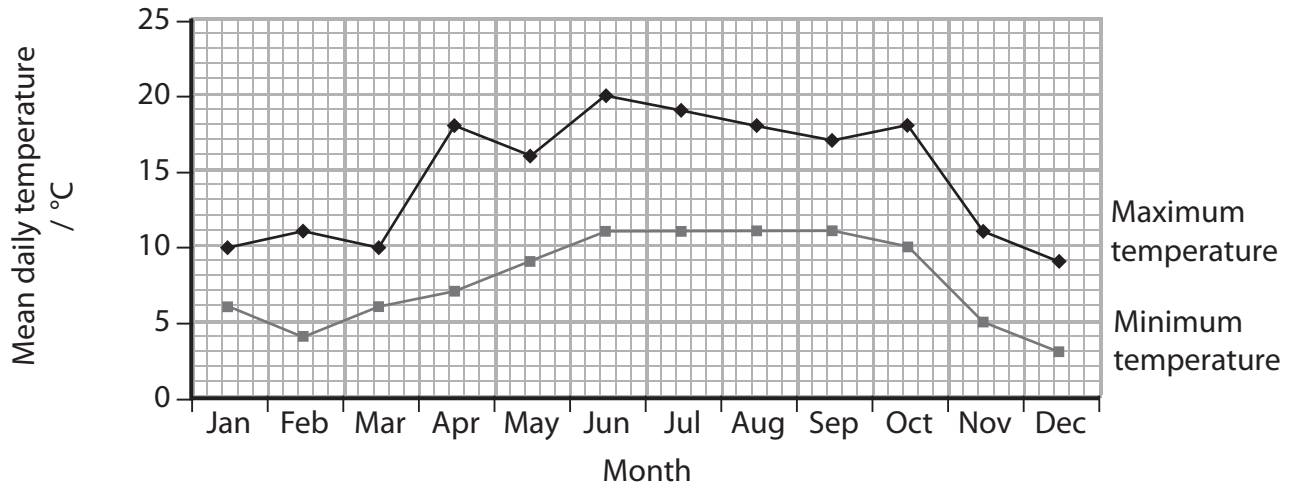
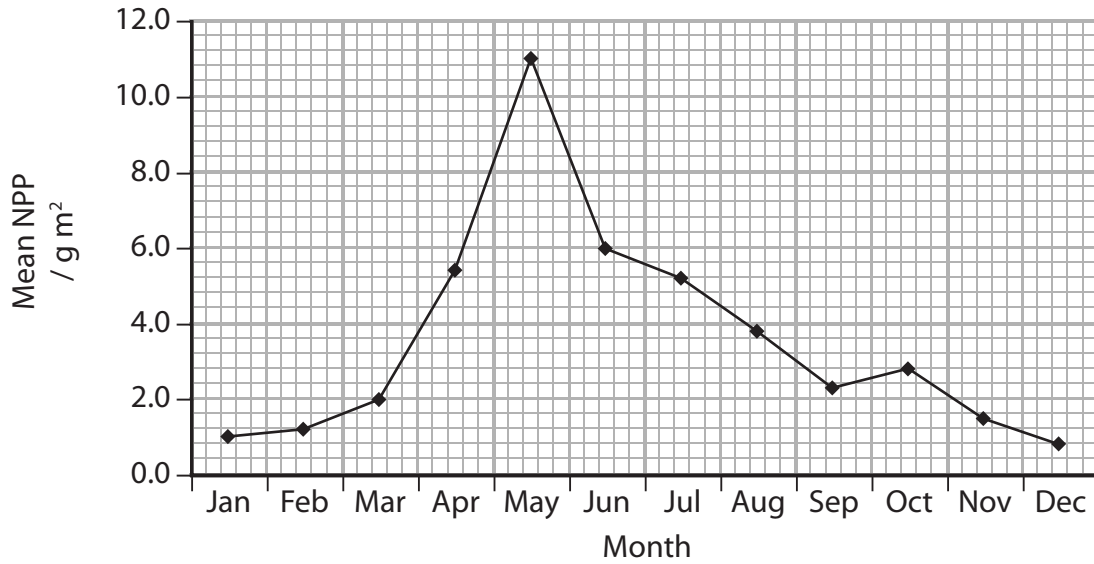


1 The graphs below show data collected at a weather station in North Wales during 2007.

The monthly means of net primary productivity (NPP), daily maximum and minimum temperatures and sunlight hours are shown for grassland at this weather station.



(a) (i) Explain what is meant by the term **net primary productivity**.

(2)

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(ii) Calculate the overall percentage increase in the mean NPP from January to May.

(3)

Answer %

(b) Suggest why an increase in temperature may cause an increase in NPP.

(2)

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(c) Using information from the graphs, describe and explain the relative effects of temperature and hours of sunlight on NPP in this grassland.

(4)

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(d) Temperature and hours of sunlight are abiotic factors.
Suggest **two** biotic factors that may influence NPP in this grassland.

(2)

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(Total for Question 1 = 13 marks)

- 2 Several species of woodlice can be found in most gardens in Britain. Woodlice have bacteria in their digestive system that secrete enzymes required for the digestion of plant cell walls. Woodlice are decomposers of dead plants.

The photograph below shows one of the common species of woodlouse found in gardens in Britain.



Magnification x10
Amateur Entomologists Society / Kieren Pitts

(a) Suggest how woodlice are involved in the recycling of carbon.

(3)

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(b) A student was watching woodlice in her garden. She noticed that woodlice on an area of paving slabs were fairly active and running about. When she lifted some of the stones near the slabs, the woodlice under these stones were relatively inactive at first. However, within a very short time these woodlice started to run about. After a few minutes, almost all of the woodlice that were under the stones had disappeared from view.

(i) The student thought that the behaviour and distribution of the woodlice were being influenced by an abiotic factor in her garden.

Place a cross ☒ in the box next to the term that describes this type of idea.

(1)

A Hypothesis

B Observation

C Prediction

D Theory

(ii) Suggest **two** examples of abiotic factors that might influence the behaviour and distribution of the woodlice in her garden.

(2)

1

2

(c) She decided to investigate the behaviour of the woodlice. She collected ten woodlice and released them into the centre of the area of paving slabs. She took photographs immediately after the woodlice were released (time 0) and each minute for ten minutes. This was repeated twice. Using the photographs, she recorded the number of woodlice on the paving slabs at one-minute intervals.

Her results are shown in the table below.

Time after release / minutes	Number of woodlice on paved area			
	1st release	2nd release	3rd release	Mean
0	10	10	10	10
1	10	9	9	9
2	9	8	9	9
3	7	7	7	7
4	7	6	5	6
5	6	6	6	6
6	4	5	4	4
7	4	3	4	4
8	3	3	2	
9	0	2	1	
10	1	1	0	

(i) Complete the table by calculating the mean for each of the final three minutes.

(1)

(ii) Suggest why taking photographs is a suitable method to count the woodlice.

(2)

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(iii) Explain why it would be difficult to determine which abiotic factor is influencing the behaviour and distribution of the woodlice in a garden environment.

(3)

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(Total for Question 2 = 12 marks)

3 Cow pats, formed from the faeces dropped by cattle, are a familiar sight in any field where cattle have been grazing. Apart from water, a cow pat consists of a mixture of organic compounds left over from the digestive processes in the cow.

Cellulose and plant fibres are efficiently digested in cattle. Therefore, the texture of a cow pat is relatively soft in comparison to the faeces of some other herbivores.

(a) (i) Place a cross ☒ in the **two** boxes next to the types of bond that would need to be broken during the digestion of cellulose in cattle.

(2)

ester ☒

hydrogen ☒

glycosidic ☒

peptide ☒

(ii) Name **two** types of plant fibre that may be present in the material eaten by cattle.

(2)

1

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(b) The first stage in the decomposition of a cow pat is known as putrefaction. Explain how carbon dioxide and ammonia are formed during this stage of decomposition.

(4)

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(c) The table below shows the mean time taken for a cow pat to decompose, at different times of the year, in a field in southern Britain.

Season	Decomposition time for cow pat / days
Early spring	140
Late spring	125
Early summer	110
Late summer	90
Early autumn	120
Late autumn	150

With reference to the data in the table, suggest why the time taken for a cow pat to decompose changes at different times of the year.

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(Total for Question 3 = 11 marks)

- 4 A pathologist was called to examine the body of a young man found partly-buried in a shallow grave. The initial examination of the body provided evidence that could be used to estimate the time of death of the young man.

One source of evidence used for an estimation of the time of death was the remains of insects found on the body.

The table below describes some of the types of insect remains found and the pathologist's notes.

Type of insect	Life cycle stage	Pathologist's notes
<i>Chrysomya rufifacies</i> (blowflies)	Pupa cases	Pupa cases empty
<i>Dermestes maculates</i> (beetles)	Third stage larval skins	Good condition
<i>Necrobia rufipes</i> (beetles)	Adult	Active

- (a) Place a cross ☒ in the box next to the term that describes the use of evidence provided by insect remains on a dead body.

(1)

- A forensic bryology
- B forensic entomology
- C forensic mycology
- D forensic neurology

(b) The flow diagram below shows the main stages in the life cycle of blowflies and beetles.

EGG → LARVA → PUPA → ADULT

(i) Place a cross ☒ in the box next to the factor that would have the most effect on the rate of development of each stage of the life cycle of insects on this dead body.

(1)

A interspecific competition

B light

C predation by birds

D temperature

(ii) Suggest how the pathologist might use the information in the table and the flow diagram to estimate the time of death of the young man.

(3)

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(c) Suggest how useful each of the following additional sources of evidence would be for the pathologist in determining the time of death of this young man. Give an explanation for each of your answers.

(i) Body temperature

(2)

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(ii) State of decomposition

(2)

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(Total for Question 4 = 9 marks)