

Forensics - Questions by Topic

Q1.

Bacteria are involved in the decomposition of organic matter.

(a) Place a cross in the box next to the type of chemical reaction that takes place in decomposition.

(1)

A condensation

B esterification

C hydrolysis

D polymerisation

(b) An investigation was carried out to study the rate of decomposition of leaves from ash trees and beech trees.

Five piles of each type of leaf were placed outside on the ground and each pile was covered with a heavy bucket. Each pile of leaves had a mass of 10 grams.

Every few weeks, one pile of each type of leaf was removed and weighed.

The table below shows the results of this investigation.

Time after falling from the tree / weeks	Mass of pile of ash leaves / g	Mass of pile of beech leaves / g
0	10.0	10.0
4	4.9	9.1
8	2.0	8.4
16	1.1	6.0
32	1.2	2.8
64	0.8	2.4

(i) Place a cross in the box next to the reason for using five piles of ash leaves in this investigation.

(1)

A to calculate a mean

B to give a range of values for the independent variable

C to make the investigation valid

D to produce reliable data

(ii) A student made the following conclusions from these results.

Decomposition of beech leaves is faster than ash leaves.

Bacteria are needed for the decomposition of beech and ash leaves.

There is a correlation between decomposition and time.

Place a cross in the box next to the number of correct conclusions made by this student.

(1)

A none

B one

C two

D three

(iii) Explain why there is a decrease in mass of the leaves.

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(iv) Suggest what effect an increase in temperature would have on the rate of decomposition of these leaves. Give an explanation for your answer.

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(Total for question = 11 marks)

Q2.

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

Microorganisms are also found on a dead body.

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

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(Total for question = 2 marks)

Q3.

Grey tree frogs are found in the USA.

The photograph below shows a grey tree frog.



Magnification $\times 1$

Cope's grey tree frog and the eastern grey tree frog are both found in the USA.

These species of grey tree frog are very similar in appearance, but have different mating calls.

A number of scientists believe that the eastern grey tree frog evolved from Cope's grey tree frog during the last ice age.

These species have different numbers of chromosomes in their nuclei. Cope's grey tree frog has two copies of each chromosome. The eastern grey tree frog has four copies of each chromosome. As a result, the cells of the eastern grey tree frog are larger.

(a) The genetic relationship between these two species of grey tree frog has been studied using DNA profiling (DNA fingerprinting).

A small sample of DNA was taken from each species of grey tree frog. This DNA was amplified, fragmented and used to produce a DNA profile (DNA fingerprint) for each species.

*(i) Describe how a DNA profile was produced from this small sample of DNA.

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(ii) Suggest how these DNA profiles were compared.

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(b) Scientists in different parts of the USA are investigating the possibility that the difference in cell size is responsible for the different mating calls. This is contributing to an understanding of the evolution of grey tree frogs.

Suggest **two** ways in which the results of their investigations can be shared.

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(Total for question = 11 marks)

Q4.

A deer was found dead on National Trust land. Some people thought that the wounds that led to the deer's death could have been caused by a big cat such as a black panther.



The DNA produced by PCR was analysed to find out if a black panther was involved.

Explain how gel electrophoresis could be used to find out if this DNA came from a black panther.

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(Total for question = 5 marks)

Q5.

A dead human body can supply a variety of evidence to support the time of death.

The table shows the relationship between the mean rectal temperature, calculated from a number of human bodies, and time after death. All bodies were at the same ambient temperature.

Time after death / hours	Mean rectal temperature / °C	Range of rectal temperature / °C
4	36	±1.8
8	31	±2.5
12	28	±3.3
16	26	±4.3
20	24	±5.1
24	22	±5.6

(a) Deduce the maximum ambient temperature.

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(b) Analyse the data to explain why a more reliable estimate of time of death could be given the dead body has a higher rectal temperature.

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(b) Analyse the data to explain why a more reliable estimate of time of death could be given if the dead body has a higher rectal temperature.

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(c) State **two** features of these bodies that could account for the variation in the data.

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(d) Explain why recording rectal temperature is more reliable than measuring skin temperature.

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(e) In addition to body temperature, forensic scientists would look for other evidence of time of death.

Give **two** other pieces of evidence from a body that allow for an estimation of the time of death.

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(Total for question = 10 marks)

Q6.

Researchers carried out a study on the prey of predatory ground beetles. They removed the contents of the guts of beetles which had been feeding and analysed them to see if they could identify the species they had fed on.

In one study, to see if the method worked, they fed the beetles on earthworms of the species *Allolobophora chlorotica* only.

DNA was extracted from the gut contents and analysed.

(a) The quantity of worm DNA in the beetle gut was very small.

Describe how sufficient DNA was produced to carry out the analysis.

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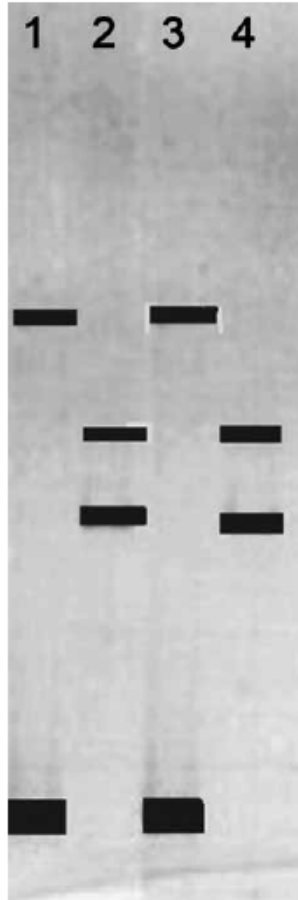
(b) (i) The DNA in the samples from the beetle guts was cut into fragments. The fragments were different for each species and had to be separated by gel electrophoresis.

Which of the following describes the movement of the DNA fragments in gel electrophoresis?

(1)

- A** large fragments move further than small fragments towards the anode
- B** large fragments move further than small fragments towards the cathode
- C** small fragments move further than large fragments towards the anode
- D** small fragments move further than large fragments towards the cathode

(ii) The picture shows one set of results in which four samples have been separated.



(Source: Evaluation of temperature gradient gel electrophoresis for the analysis of prey DNA within the guts of invertebrate Sheppard et al. Cardiff School of Biosciences)

Explain what these results show you about the diet of the ground beetles.

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(Total for question = 6 marks)