Biology 1.6 - Ecosystems & Human Impact on Environment - Higher Tier

Question 1.

Examiner only

Biogas is a mixture of carbon dioxide and methane. It is produced in the soil in land-fill waste dumps and is sometimes collected and sold as fuel.
The same type and mass of waste was regularly dumped in a land-fill site for many years. The volume of biogas produced decreased after the heavy metal, lead, was illegally dumped there.

(a) Explain how carbon dioxide is produced in the land-fill site. [2]

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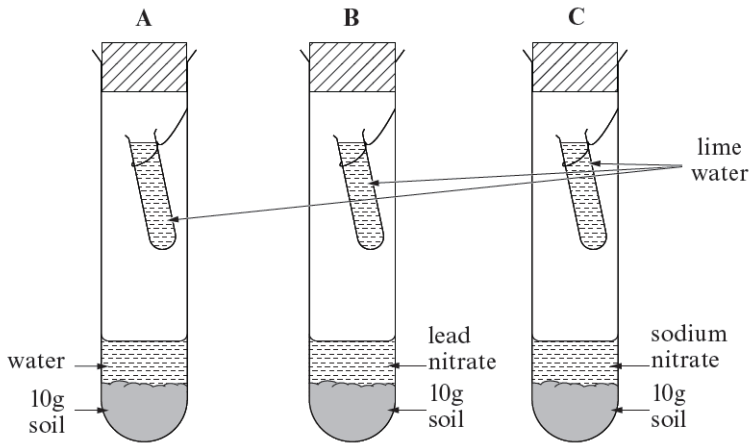
(b) In order to prove that lead caused the decrease in the production of carbon dioxide, an investigation took place using the following apparatus.

NOTE: Lime water changes from clear to milky in the presence of carbon dioxide.



The apparatus was left for 24 hours and the results were as follows:

	Tube		
	A	**B**	**C**
Lime water	milky	clear	milky

(i) Explain the results in **B**. [2]

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(ii) Explain the purpose of sodium nitrate in **C**. [1]

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(iii) Describe how you would set up a fourth tube D, to show that microorganisms were responsible for causing the colour change in the lime water. [1]

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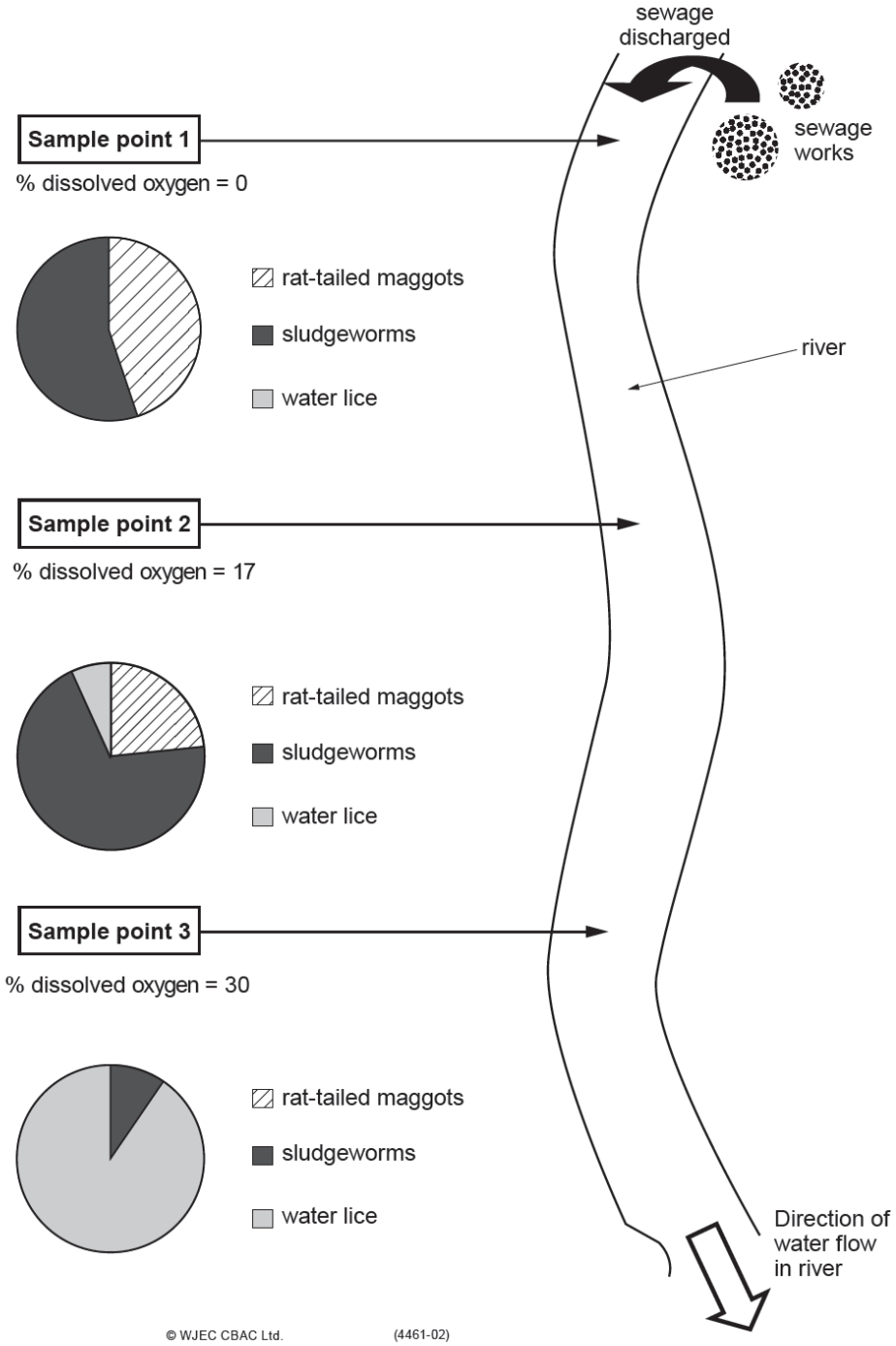
Question 2.

Recent flooding in the UK caused a sewage discharge into a river. Two weeks after the discharge the Environment Agency took samples of river water at 3 sample points 0.5 km apart.

The percentage (%) of dissolved oxygen in the sample was measured and the animals in the samples were counted and the data plotted as pie charts. The results are shown below.



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Use the information from the diagram opposite to answer the following questions.

(a) The presence of which **two** animals in the samples indicates **high** levels of water pollution? [2]

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(b) Which animal cannot live in highly polluted water? [1]

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(c) (i) What happens to the percentage of dissolved oxygen as the water flows downstream? [1]

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(ii) Rat-tailed maggots need oxygen to live. Suggest how they can live at **Sample point 1** where there is no oxygen dissolved in the water. [1]

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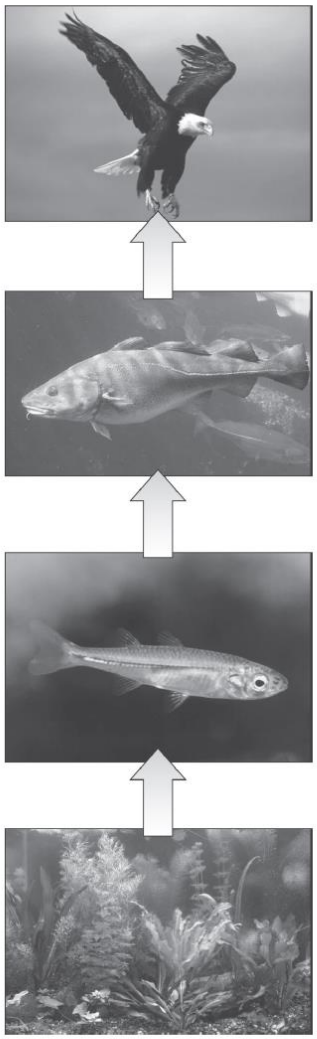
Question 3.

DDT is a powerful insecticide which was extensively sprayed onto crops in the middle part of the twentieth century. Its use is now banned in many regions of the world because it resulted in the death of many top predators. One of the top predators affected was the American Bald Eagle *(Haliaeetus leucocephalus)* whose numbers in the USA dropped to only 834 in 1963.

The food chain below shows the concentration of DDT in ppm (parts per million) in the tissues of the organisms in a food chain.



American Bald Eagle
13.8 ppm

large fish
2.07 ppm

small fish
0.23 ppm

aquatic plants
0.04 ppm

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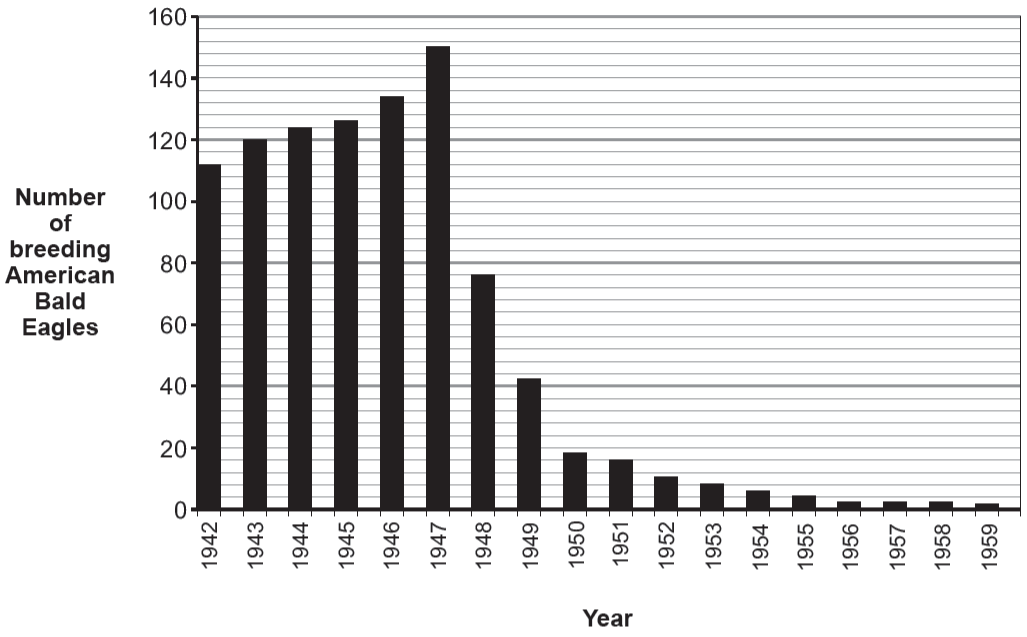
The graph below shows the number of breeding American Bald Eagles in Florida between 1942 and 1959.



(a) Suggest why DDT is found in the aquatic plants if it is only sprayed onto crops grown on land. [1]

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(b) The aquatic plants and fish are not killed by the DDT but the American Bald Eagle is. Explain the reason for this. [2]

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Question 4.

Examiner only

A scientist investigated the transfer of energy between an oak tree and organisms living on it. She recorded the data in the following table:

use of the energy	kJ per m^2 per year
absorbed by the oak tree	4 600 000
transferred to carbohydrates	44 000
transferred to herbivores	2 920
transferred to carnivores	700

(a) Calculate the percentage of the energy absorbed by the oak tree that is transferred to carbohydrates. Show your working and give your answer to the **nearest whole number**. [2]

Answer ..... %

(b) Explain why only a small proportion of the total energy is transferred to the carnivores. [2]

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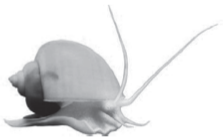
Question 5.

Examiner only

Some organisms living in a large lake and their total biomass in kg are shown below.

They are **not** drawn to scale.



Snails
4 500 kg

Pike
250 kg

Aquatic plants
45 000 kg

Minnows
500 kg

Beetles
800 kg

(a) (i) Which of the organisms above are likely to be present in the least numbers? [1]

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(ii) The organisms above all form part of the same food chain.
In the space below, draw a **labelled** diagram to show a pyramid of biomass containing **all** of these organisms. [2]

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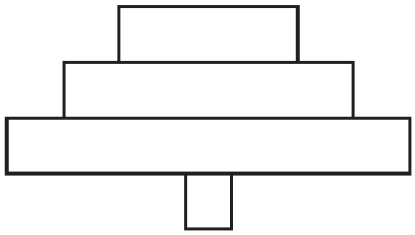
(iii) The pike in the lake are affected by a parasite, called a fish louse, which lives on their skin. There would be many of these parasites on each pike but their biomass would be less than the biomass of the pike.

How would you add this information to the pyramid you drew in *(a)*(ii)?

Tick (✓) the correct answer. [1]

- Place them at the tier above the pike ☐
- Place them at the bottom of the pyramid ☐
- Place them below the minnows ☐
- Place them in the tier below the pike ☐

(b) Explain how a pyramid of numbers, for some organisms living on land, could look like the one shown below: [2]



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