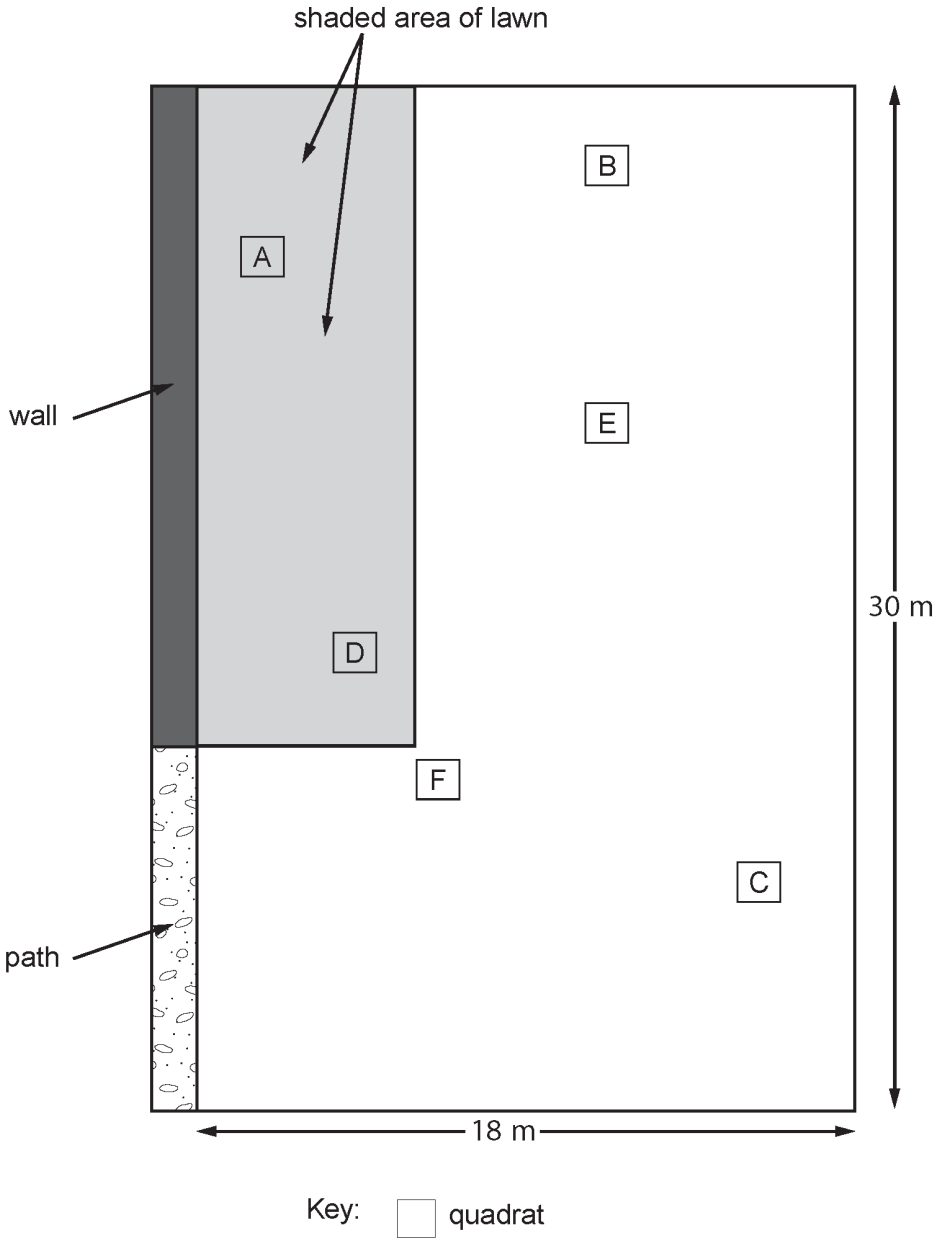
WJEC (Eduqas) Biology GCSE Topic 6.3 Biodiversity Questions by Topic

1. Some students investigated the number of dandelion plants on a lawn. The diagram shows the lawn and the location of 6 quadrats (A to F) which the students had placed at random on the lawn.



The students counted the number of dandelions in each quadrat and recorded their results in the table below.

quadrat	number of dandelions
A	7
B	2
C	1
D	6
E	2
F	0

(a) Each quadrat measured $1\,m^2$.
Calculate the mean number of dandelions per square metre for the 6 quadrats. [1]

Mean number of dandelions = ...

(b) Calculate the area of the lawn. [1]

Area of lawn = ...

(c) Use your answers from parts *(a)* and *(b)* to estimate the total number of dandelions on the lawn. [1]

Estimated total number of dandelions = ...

(d) In fact, the **actual** number of dandelions on the lawn is 1250.
Use the formula below to calculate the percentage error of the estimate in part *(c)* above. [1]

$$\text{percentage error} = \frac{\text{estimated number of dandelions} - \text{actual number of dandelions}}{\text{actual number of dandelions}} \times 100$$

percentage error = ... %

(e) How could the strength of evidence in the investigation be improved? [1]

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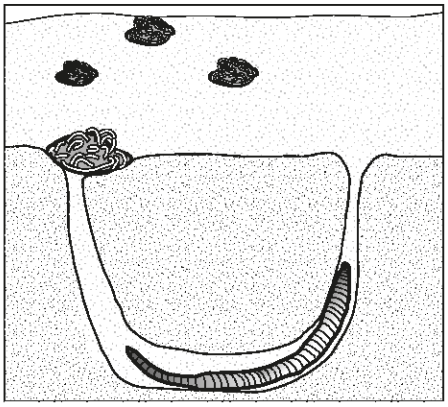
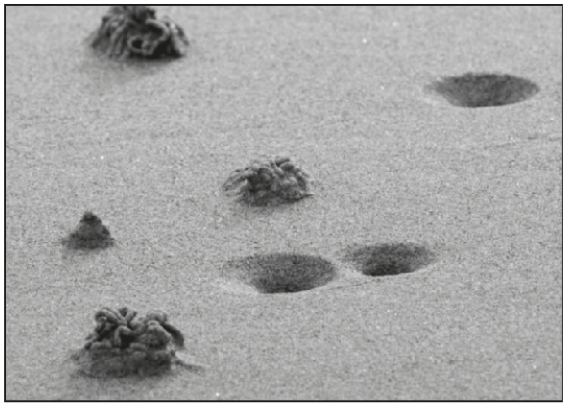
2. Lugworms *(Arenicola marina)* live in burrows in the sand on beaches. At one end of the burrow is a hole and at the other end is a mound of sand, called the cast, which the lugworm has removed from the burrow. Each burrow is occupied by one lugworm only.

Burrow in section



Surface view



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Owen was asked by his teacher to estimate the number of lugworms, on a section of Whiteford Beach on Gower, by counting the number of casts.

Owen decided to use 1 m^2 quadrats to estimate the number of lugworms present in an area of the beach measuring 80 m × 40 m.

(a) Which of the following methods would be the correct way for Owen to use the quadrats to sample the number of lugworms? [1]

Tick (✓) the correct answer.

method	tick (✓)
Place the quadrats where there are lots of casts	
Place the quadrats randomly within the sample area	
Place the quadrats carefully so as not to damage the casts	

(b) Owen counted the number of casts in 10 quadrat samples.
The table below shows his results.

quadrat number	number of casts
1	5
2	7
3	1
4	11
5	4
6	6
7	9
8	4
9	13
10	2
Mean	.....

(i) Complete the table above by calculating the mean number of casts per quadrat of Owen's samples. [1]

(ii) Estimate the number of lugworms in the section of the beach by using the following equation: [2]

Estimated number of lugworms = Mean number of casts per quadrat × Area of section of beach

Estimated number of lugworms .....

(c) Suggest why this method of sampling would **not** be suitable for estimating the population of earthworms in an area of grassland. [1]

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3. The Rose-bay willow-herb, *Epilobium angustifolium* is a plant that produces wind dispersed seeds.

The survival of this plant in its natural habitat was studied by counting the number of

- seeds found on the ground,
- seedlings,
- fully grown plants.

The counts were completed every 2 metres away from the parent population.

All counts were taken in the direction of the prevailing wind (direction in which the wind mainly blows).

The results are shown in the table:

distance from parent population (m)	seeds (per m^2)	seedlings (per m^2)	fully grown plants (per m^2)
2	22	20	0
4	30	25	0
6	31	30	0
8	28	25	1
10	25	20	2
12	18	15	3
14	9	9	5
16	8	5	5
18	4	3	3

(a) Name:

(i) the technique you would use to obtain the data shown in the table; [1]

.....

(ii) **two** items of apparatus used to make the necessary measurements for this technique. [2]

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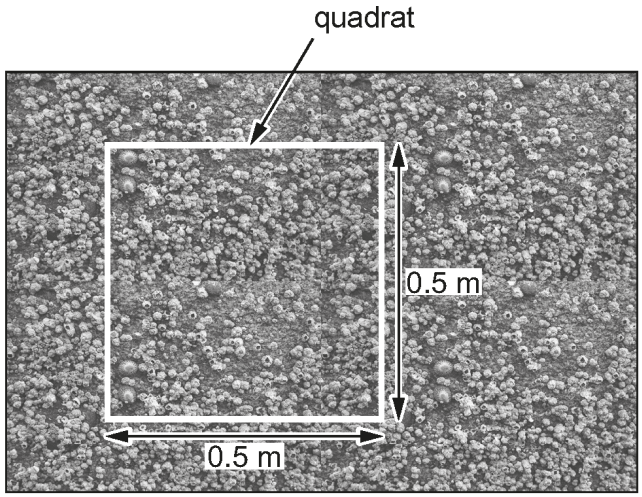
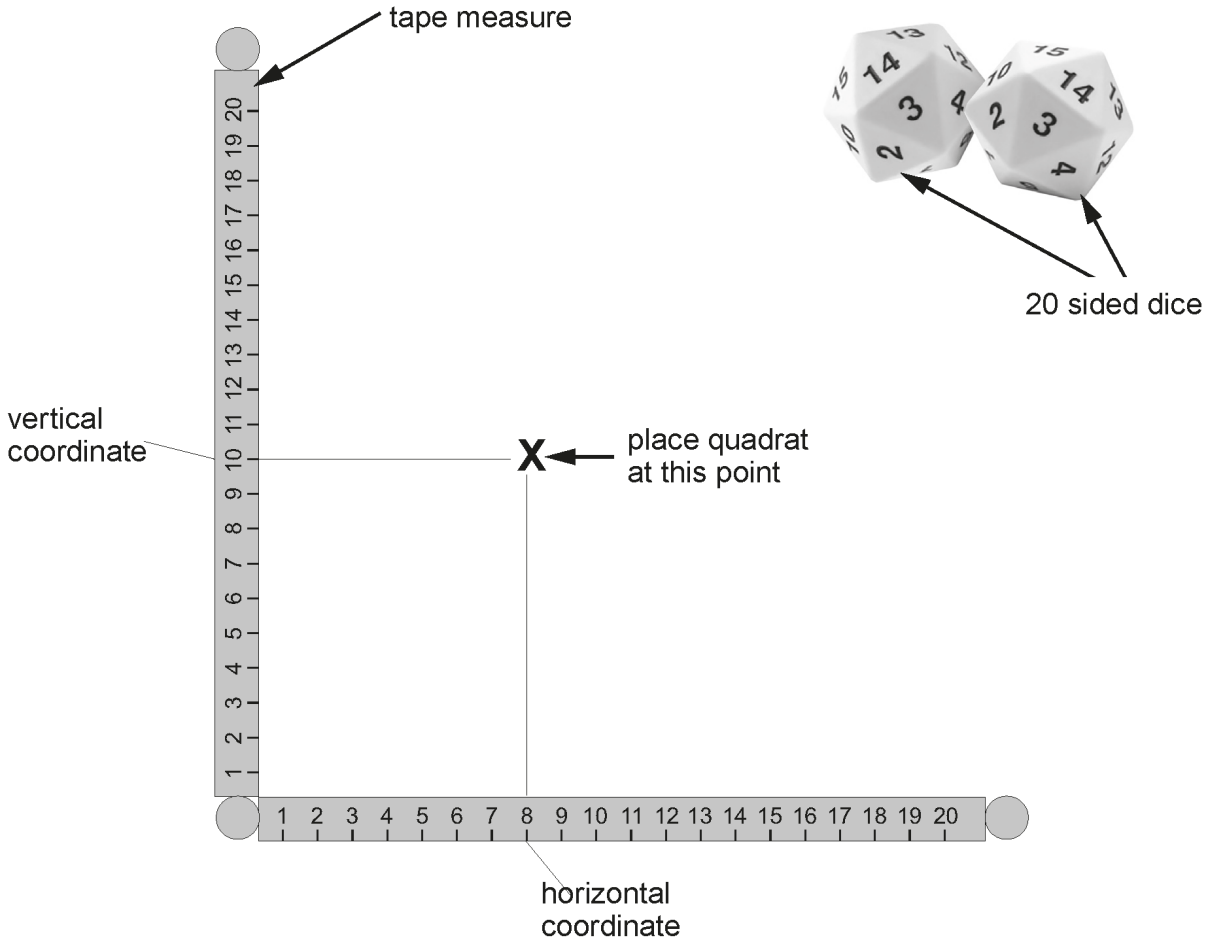
(b) Calculate the percentage of seeds that survived to produce fully grown plants at 10 m from the parent plants. Show your working. [2]

4. Mair and Gavin investigated the abundance of barnacles *(Semibalanus balanoides)* using a 0.5 m × 0.5 m quadrat on a 20 m × 20 m section of rocky shore.



The photograph shows a 0.5 m × 0.5 m quadrat placed on a part of the rocky shore. The barnacles are attached to rocks.

Initially Mair and Gavin marked out the section of rocky shore with two 20 m tape measures placed at right angles to one another. This is shown below.



They threw two 20 sided dice in order to select the placement of the quadrat.

(a) Explain how and why Mair and Gavin used this method to decide the position at which the quadrat was placed inside their sample area. [2]

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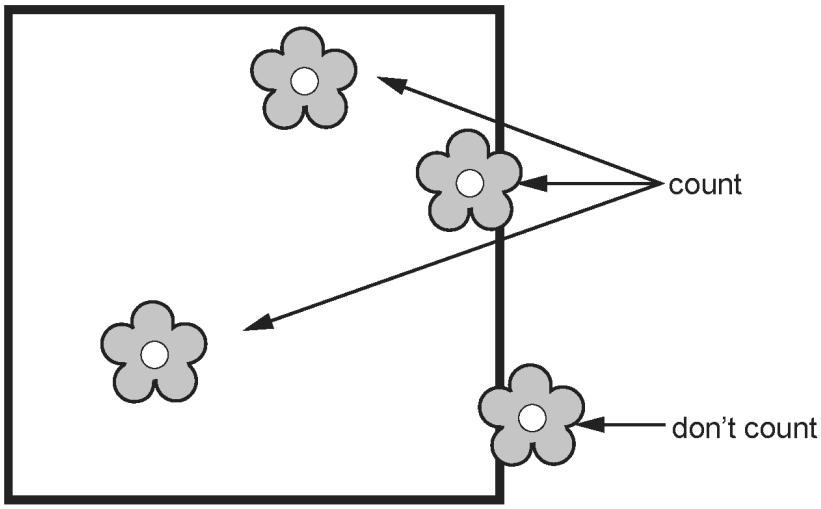
(b) Mair and Gavin wanted to sample at least 2% of their chosen area of rocky shore for barnacles. How many quadrats would they have to place? Show your working. [2]

Number of quadrats required .....

(c) Mair and Gavin's teacher gave them the following illustration about counting species using a quadrat.



Suggest what rule of counting, using a quadrat, the illustration shows. [1]

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(d) State **one** other method that could be used to measure the changes in abundance and distribution of species on a rocky shore. [1]

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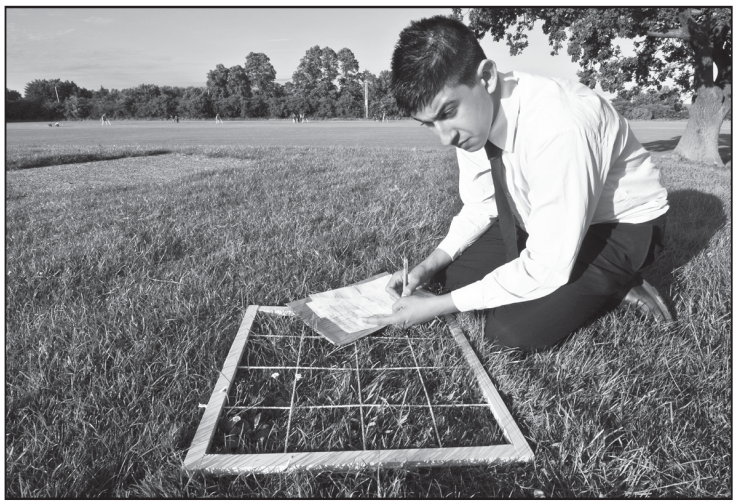
5. Some students wanted to estimate the number of dandelions on a school playing field. The playing field was too large to count every dandelion so they sampled a 10m × 10m area of the field using a quadrat.



(a) The stages the students used in their sampling technique are listed below in the **WRONG ORDER**. Write the numbers **1**, **2**, **3** and **4** in the table below to show the correct order. [3]

Stage in the sampling technique	Number
Calculate the number of dandelions on the playing field	
Repeat the sampling 10 times	
Select a random sampling method	
Drop the quadrat and count the number of dandelions	

(b) Why is it important that when the students sample in the chosen area of the field it is done randomly? [1]

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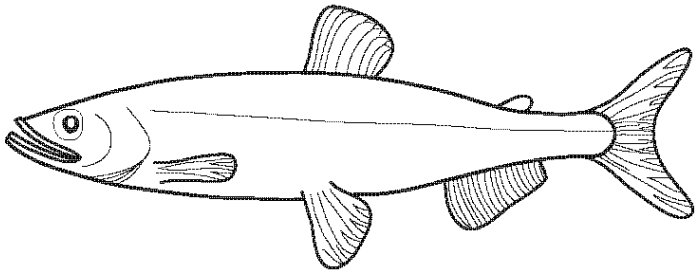
6.

In South Wales, a population of fish called smelt *(Osmerus eperlanus)* live in a lake, into which runs a stream.

Smelt, *Osmerus eperlanus*



An estimation of the population size of the smelt in the lake was made using a capture/recapture technique.

200 smelt were captured from one part of the lake and their tails were marked with a harmless blue dye. The marked smelt were then returned to the lake.

The next day, 200 smelt were again captured in the same part of the lake. 20 of these were found to have been marked with the dye and 180 were unmarked.

(a) Estimate the size of the population of smelt in the lake by using the formula [2]

$$\text{Population size} = \frac{\text{Number captured on first day} \times \text{number captured on the second day}}{\text{Number of marked smelt recaptured on second day}}$$

Show your working

Answer .....

(c) Apart from emigration, suggest **three** *other* reasons why your estimate is unlikely to be an accurate indication of the actual population size of the smelt in the lake. [3]

(i) .....

(ii) .....

(iii) .....

7. A group of students were asked to calculate the population size of garden snails *(Helix aspersa)* in 5 different areas of similar size in the school grounds. They sampled the five areas of the school grounds early in the morning on a damp day. The students sampled each area once only and counted the number of snails they found. The shell of each snail was marked with a small spot of white ink. The snails were then released.

Garden snail marked with white ink

Approximately one week later, on a damp morning, the students sampled the same areas of the school grounds a second time. This time they recorded the number of recaptured snails (the ones that had been marked with white ink a week earlier) and the number of snails which had not been marked with white ink.

The table below shows the capture – recapture results obtained by the students.

Area of school grounds	No. of snails captured and marked in 1st sample	No. of snails in 2nd sample	No. of snails in 2nd sample previously marked	Population size
playing field	3	2	1	6
hedgerow	9	4	3	12
flowerbed	7	4	2	14
boundary wall	11	9	5	20
vegetable garden	23	17	10	.....

(a) Use the equation below to calculate the population size for the snails living in the vegetable garden. **Write your answer in the table above.** [2]

$$\text{population size} = \frac{\text{number in 1st sample x number in 2nd sample}}{\text{number in 2nd sample previously marked}}$$

Space for working

(b) State **one** way in which the students kept their investigation fair. [1]

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(c) The song thrush *(Turdus philomelos)* feeds on snails. During the week after marking the snails with white ink some of the students noticed that the number of song thrushes in the five areas of the school grounds had increased. This increase may have been due to a problem resulting from the students' method. Suggest why the number of song thrushes increased and how the students could overcome the problem. [2]

Song thrush eating garden snail

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8. Write an account of some of the different methods of protecting endangered species of animals and plants around the world. Include the use of legislation in your answer. [6 QWC]

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9.

A fruit grower needs to control an insect pest in his orchard. Before deciding on a method of pest control to be used, it was necessary to estimate the size of the population of the insect pest in the orchard. This was done as follows:

- A large number of the insect pest was captured in the orchard, then marked and released there.
- A few days later the population was again sampled and the captured insect pests were found to include some marked ones.

(a) The formula which is used to estimate the total number of insect pests is given as:

$$P = \frac{Q \times R}{S}$$

where:

- P is the total number of insect pests in a population
- Q is the number of insect pests in the first sample
- R is the number of insect pests in the second sample
- S is the number of marked insect pests in the second sample

(i) Give a possible source of error in this method of estimating the size of a population. [1]

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(ii) How would you improve the method to increase your confidence in the result? [1]

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(b) In 2012, the European Union passed a law which required the use of both predators and specific pesticides to control pests.

(i) What term describes the use of natural predators to kill pests? [1]

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10. The black-faced lion tamarin *(Leontopithecus caissara)* is a species of monkey living in the rainforests of South America.

(a) The black-faced lion tamarin is classified as Critically Endangered on the IUCN red list and listed on Appendix 1 of CITES. There are only about 400 individuals remaining in the wild.

(i) On the sliding scale above suggest what will happen to the black-faced lion tamarin unless measures are taken to conserve the species. [1]

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(ii) If conservation measures fail, state what will happen to the biodiversity of the habitat in which the black-faced lion tamarin lives. [1]

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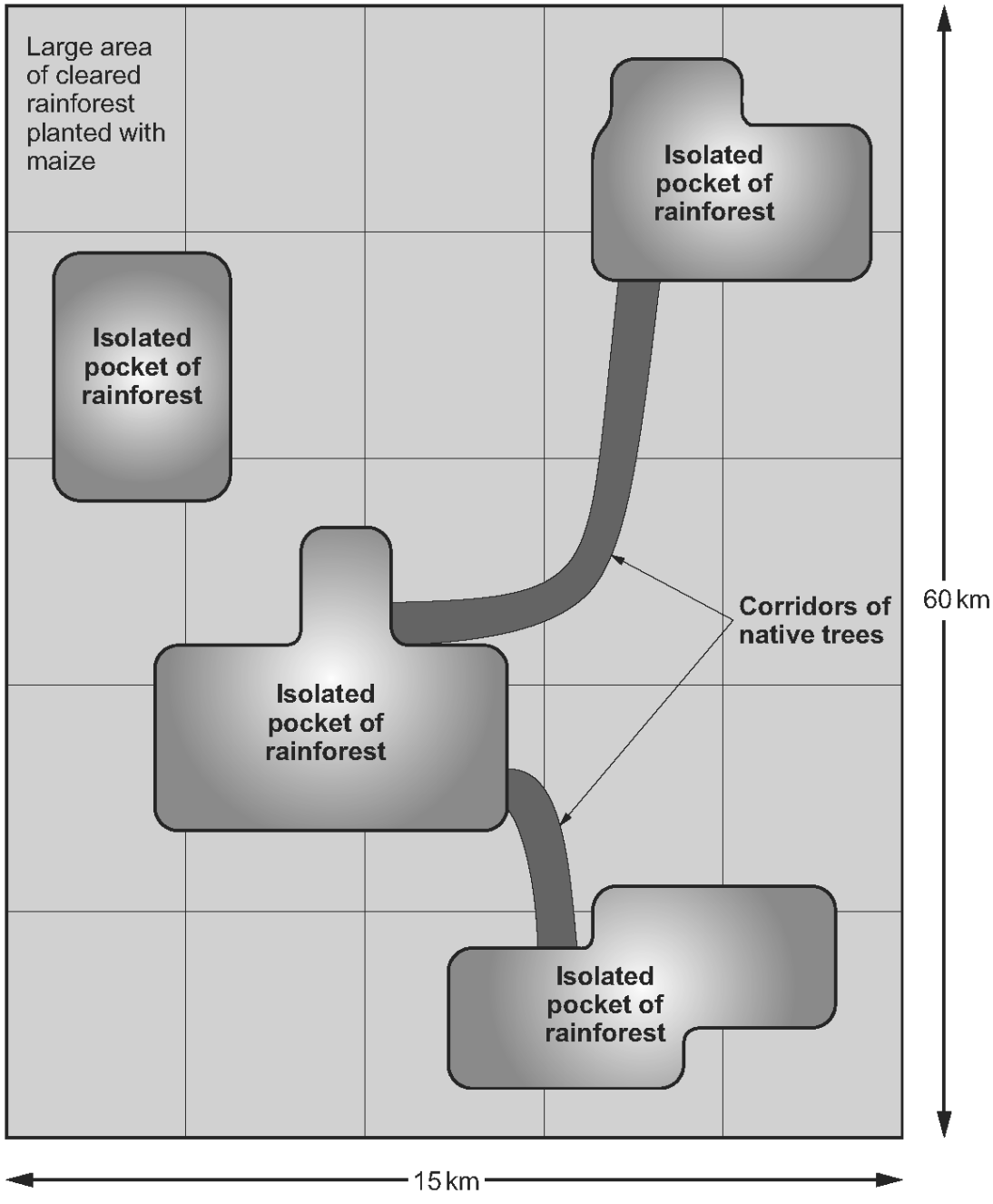
(b) The rainforest habitat of the black-faced lion tamarin has been cleared to grow maize. Small populations of the monkey now live in isolated pockets of rainforest. The local people are being paid to start local plant nurseries and to plant corridors of native trees which link up the isolated pockets of rainforest.

The diagram shows an aerial view of 900 km^2 of rainforest which has been cleared and planted with maize.



(i) Suggest **one** reason why the local people are prepared to give up some of their farmland in order to create the corridors of native trees. [1]

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(c) State **one** *other* way in which endangered species can be conserved. [1]

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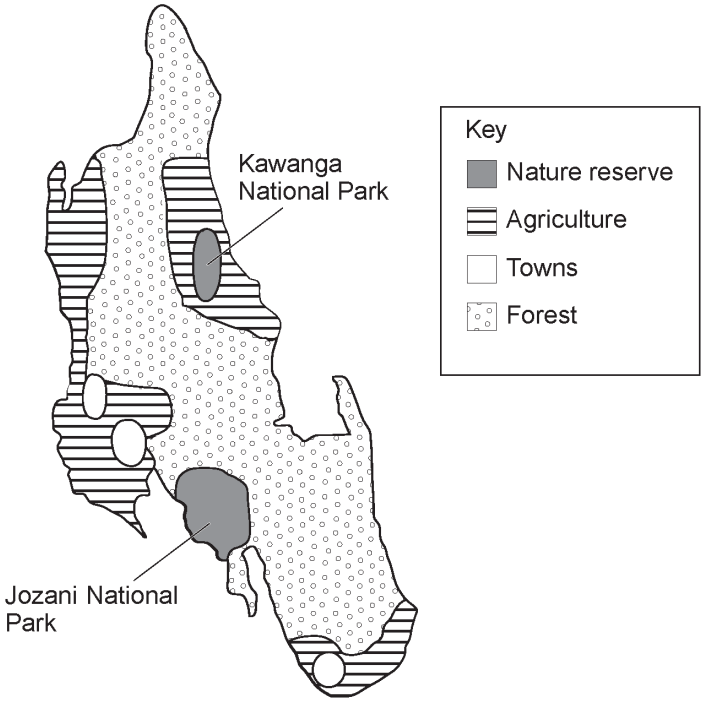
11. The red colobus monkey *(Procolobus kirkii)* lives in forests on the island of Zanzibar, feeding on leaves and tree bark. It is an endangered species and its numbers are declining because of human activities. This is despite the species being protected in the National Parks.

In 2012 conservationists estimated that there were 1600 red colobus monkeys on the whole island, with 50% of them living in the Jozani National Park. 150 colobus monkeys were then moved from the Jozani National Park to the Kawanga National Park to increase the population there. The diagram below shows a map of the island of Zanzibar.



Fact File – Human activities which harm the red colobus monkey.
The illegal capture for sale as pets in other countries.
Destroying habitat by using land.
Poisoning and hunting by farmers.

(a) Use only the information opposite to answer the following questions.

(i) What is the habitat of the red colobus monkey on the island of Zanzibar? [1]

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(ii) Give **two** ways in which the use of land by humans has caused the habitat to be destroyed. [2]

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12. In 1825, plant collectors brought Japanese knotweed *(Fallopia japonica)* into the UK. It spread into many habitats, mostly near rivers. It is now out of control in most areas, eliminating other plant species and damaging roads and buildings.

Japanese knotweed in summer

sap-sucking louse

Japanese knotweed grows rapidly in summer. Plants reach 4 metres in height and underground stems grow to 25 metres in length.

Scientists working for the Welsh government investigated the use of a sap-sucking louse *(Aphalara itadori)*, to destroy Japanese knotweed in a number of trials in parts of the UK.

In the trials, the louse reduced the growth of Japanese knotweed by 60%. The louse did not harm any other species and reproduced quickly in summer. Most of the lice, however, died in the winter.

(a) (i) Which of the following describes Japanese knotweed in the UK? Write the correct letter in the box. [1]

A an endangered alien species

B an alien invasive species

C an endangered native species

D a native invasive species

answer ☐

(ii) How does Japanese knotweed affect biodiversity in the areas where it grows in the UK? Give a reason for your answer. [1]

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.....

(b) (i) State the scientific term used when an organism is used to destroy a pest species. [1]

.....

(ii) Calculate the length of underground stems produced in Japanese knotweed when the sap-sucking louse is present. [2]

length = ... m

(c) (i) Following the trials, the scientists concluded that the sap-sucking louse was effective against Japanese knotweed as it reduced growth by 60%.

They also decided that it would be suitable to use this method on a wider scale throughout the UK. Give **one** piece of evidence which supports this decision. [1]

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(ii) How could these scientists check that the results were reproducible? [1]

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