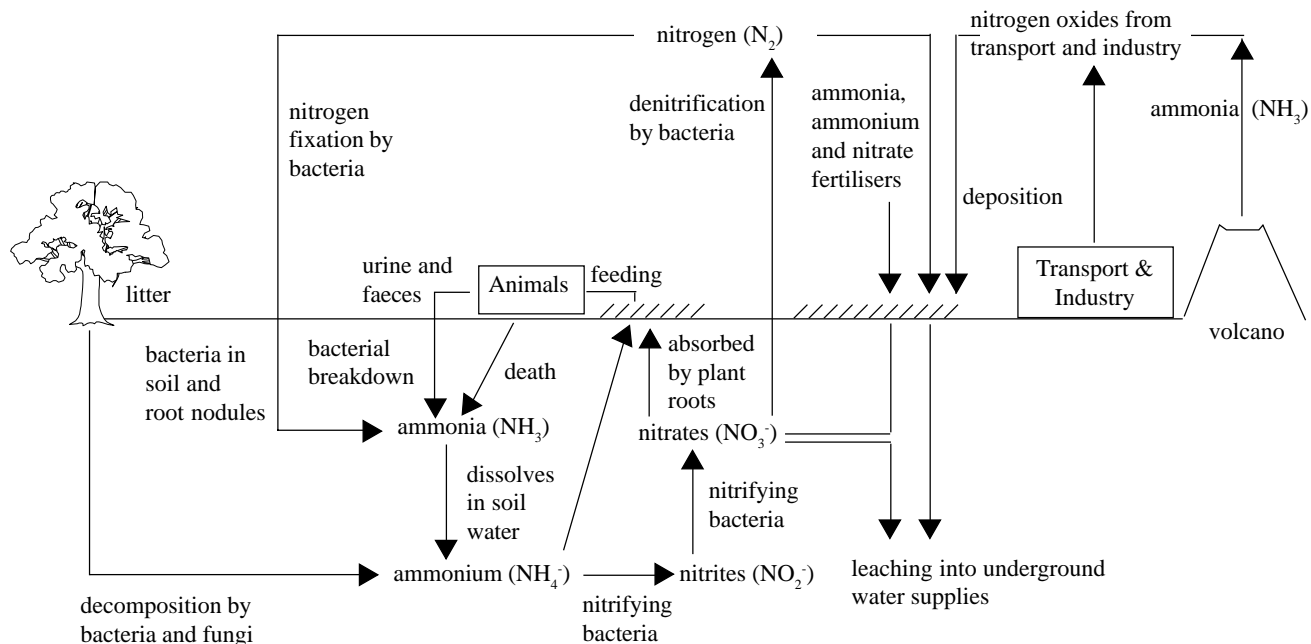


The diagram shows the nitrogen cycle.



(a) Suggest how the following human activities have disrupted the natural nitrogen cycle.

(i) agriculture:

 [4]

(ii) transport:

 [3]

(b) Describe the following processes.

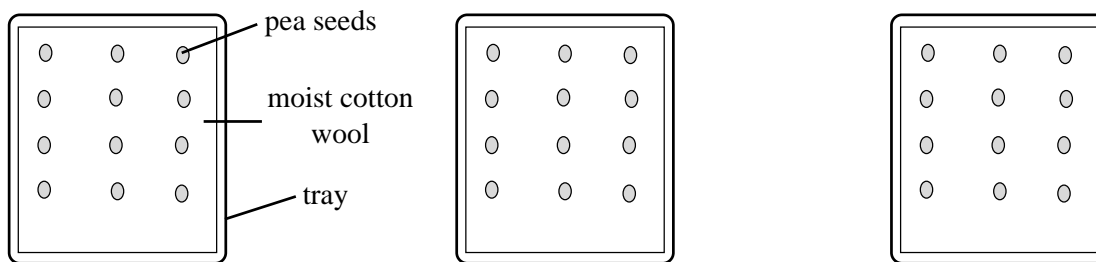
(i) nitrification:

 [3]

(ii) eutrophication and its results:

 [4]

A precursor of juglone is found in the leaves of the black walnut tree (*Juglans nigra*). Juglone is toxic to many plants and it has often been observed that very few plants grow beneath black walnut trees. A student, investigating the effect of juglone on seed germination, set up the apparatus shown below.



Tray 1

Cotton wool moistened and watered with 0.01% walnut leaf extract solution

Tray 2

Cotton wool moistened and watered with 1% walnut leaf extract solution

Tray 3

Cotton wool moistened and watered with 10% walnut leaf extract solution

(a) Outline how the student could have obtained the 10% walnut leaf extract.

.....

.....

.....

..... [4]

(b) Suggest two precautions which the student would need to follow when setting up and conducting this investigation.

1:

2: [2]

(c) Suggest what data the student would have recorded in this investigation.

..... [1]

(d) Suggest how the effect of juglone on germination was measured.

.....

..... [2]

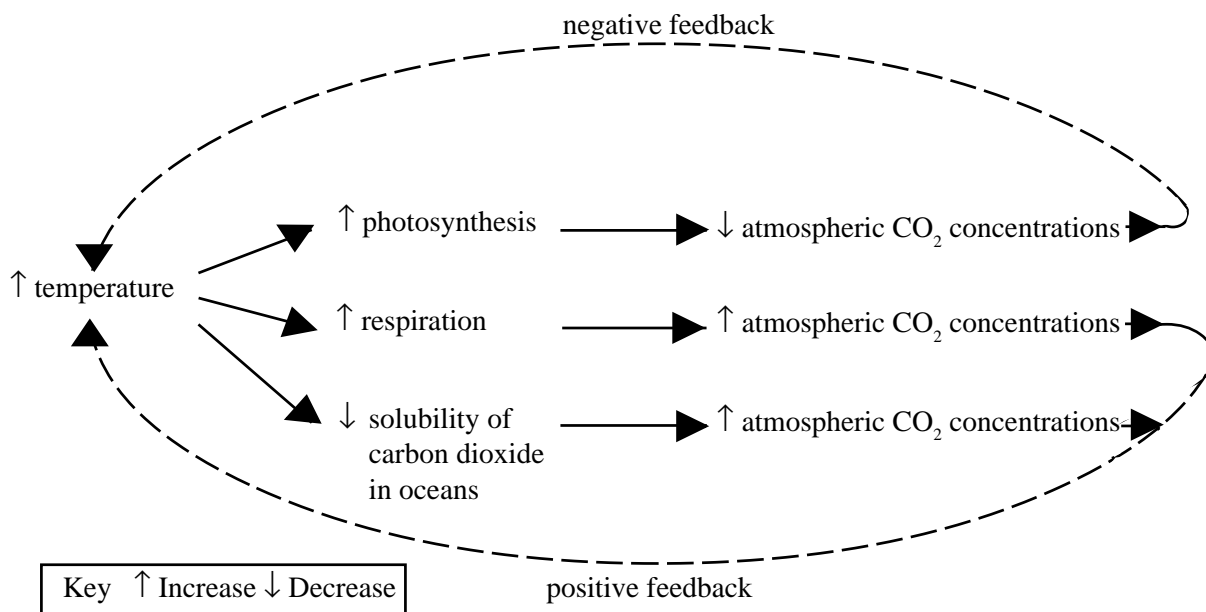
(e) During leaf fall and decay juglone is released into the soil. Suggest the ecological significance of juglone to walnut trees.

.....

.....

..... [2]

The diagram shows some of the possible effects of the enhanced greenhouse effect (global warming) on some biological processes.



(a) Using information in the diagram and your own knowledge, explain why:

- (i) increasing temperature may increase the rate of photosynthesis.

.....
 [2]

- (ii) increasing carbon dioxide concentration may stimulate the process of global warming.

.....

 [3]

(b) The net effect of increasing temperature may be an increase in atmospheric CO_2 concentrations. Suggest reasons for this.

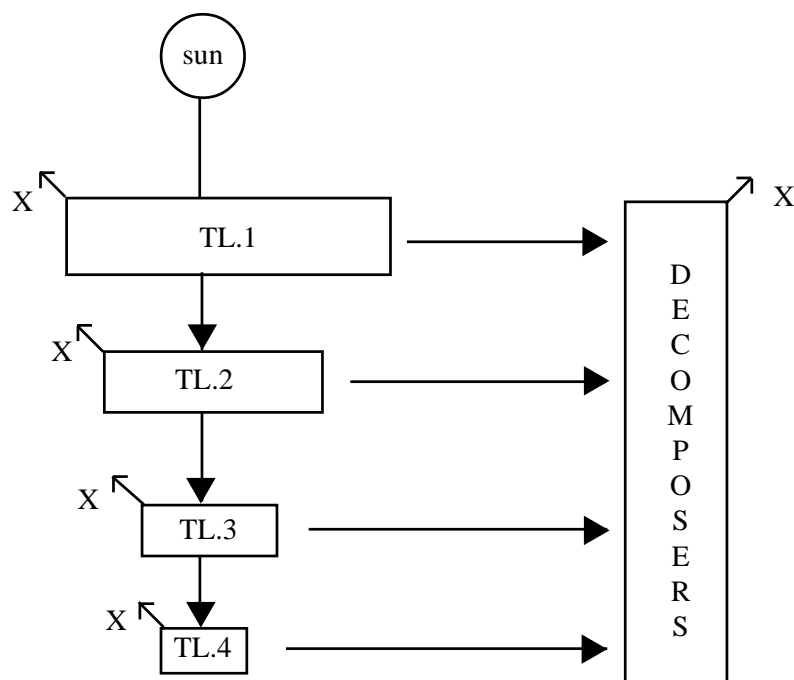
.....

 [3]

(c) Besides CO_2 several other gases may contribute to the greenhouse effect. Name another greenhouse gas.

..... [1]

The diagram shows energy flow between trophic levels.



(a) Explain why the size of the boxes decreases at each trophic level.

.....

.....

.....

[3]

(b) Identify process X.

.....

[1]

(c) Outline how a nitrogen atom in a protein in the leg of a rabbit may, within a month, become part of a chlorophyll molecule of a grass plant.

.....

.....

.....

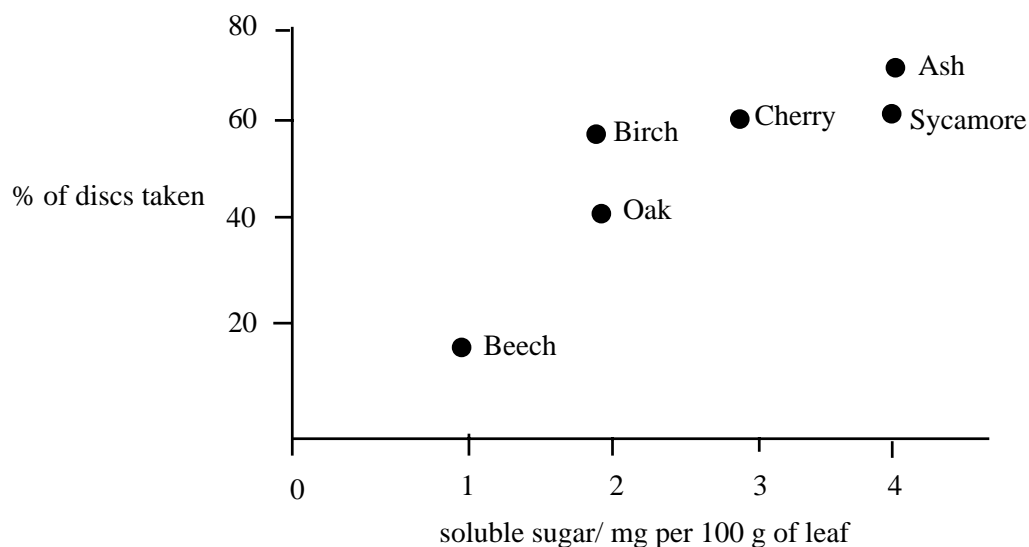
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.....

[4]

QUESTIONSHEET 5

A student carried out an investigation to see whether the sugar content of leaves would affect their palatability to the earthworm *Lumbricus terrestris*. The student filled a large dustbin with garden soil containing *L. terrestris*. Leaf discs (1 cm diameter) of different tree species and known sugar content were then placed on the surface of the soil. The proportion of discs of each species removed by the worms over a period of 10 days was measured. The result of the investigation is shown in the graph.



(a) Comment on the results shown.

.....
 [2]

(b) Describe one technique which the student could have used to measure the soluble sugar content of the leaves.

.....

 [5]

(c) Suggest two precautions which the student would need to have taken in setting up the investigation.

1
 2 [2]

(d) Suggest one other leaf characteristic which may influence palatability.

..... [1]

The table below describes some of the features of organisms which are able to carry out nitrogen fixation.

Organism	Feature
root nodules of clover (a legume)	contain haemoglobin
Cyanobacteria	contain heterocysts which are specialised cells where nitrogen fixation occurs, but photosynthesis does not
Azotobacter (a free-living soil bacterium)	maintains a very high rate of aerobic respiration in certain cells

(a) What is meant by the term nitrogen fixation?

.....

.....

[2]

(b) Suggest the significance of the features shown in the table.

.....

.....

.....

[2]

(c) (i) It is possible that other species of plant may be genetically modified to give them nitrogen fixing ability. Outline the possible harmful effects of this.

.....

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.....

[3]

(ii) Suggest why ploughing and drainage of arable fields may reduce denitrification.

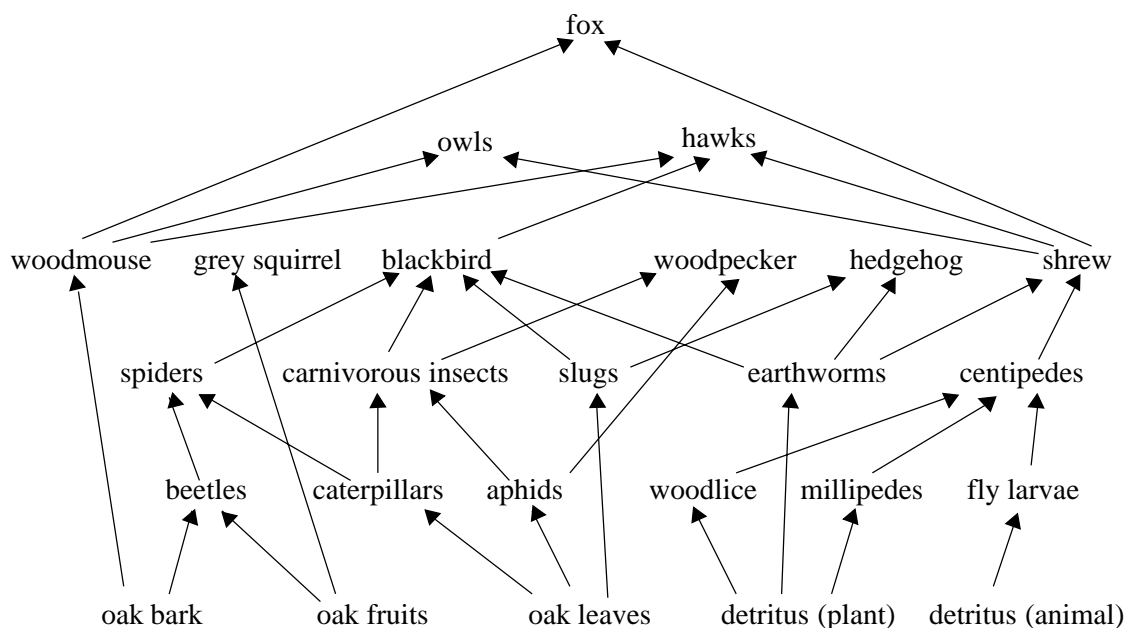
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[2]

The diagram shows part of a food web of an oak woodland.



(a) What do the arrows in the diagram represent?

..... [1]

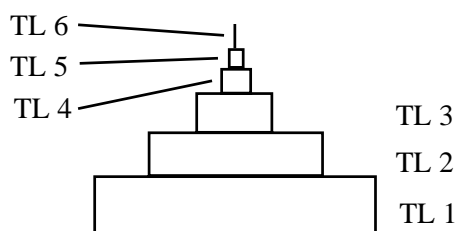
(b) Name:

(i) three organisms which are primary consumers.

..... [1]

(ii) an organism which is a secondary and tertiary consumer. [1]

The diagram below shows the estimated pyramid of numbers at each trophic level (TL) in the woodland.



(c) Explain the shape of the diagram.

.....

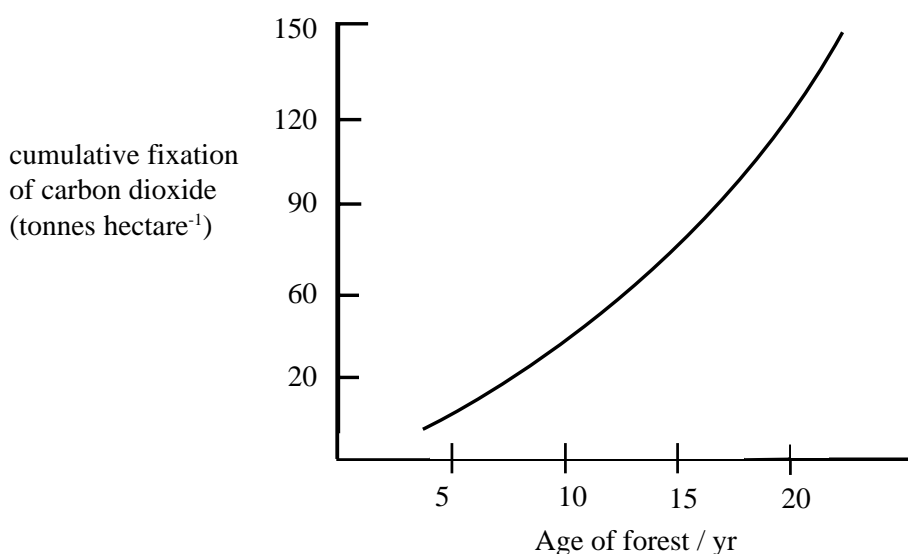
[4]

TOTAL / 7

A town in Arizona, USA has decided to 'fight global warming' by planting forests around the town to absorb all of the carbon dioxide (CO_2) which the inhabitants produce. Their estimated production of CO_2 is shown below.

Source	CO_2 production (tonnes year ⁻¹)
Domestic	30,000
Industrial	59,000
Transport	31,000

The town intends to plant a sufficiently large area of forest such that, by the end of 20 years, the forest will have absorbed exactly the same amount of carbon dioxide that the town has produced in that time. The cumulative carbon dioxide fixation of a forest is shown in the graph below.



(a) Calculate:

- (i) the total mass of carbon dioxide which the town will produce in 20 years. Show your working.

Answer: [2]

- (ii) the total area of forest which the town should plant, so that, in 20 years time, all of the town's CO_2 will have been absorbed. Show your working.

Answer: [2]

(Continued.....)

(b) Explain the term 'greenhouse effect'.

.....

.....

.....

[3]

(c) Suggest why higher average temperatures may:

(i) increase the rate of photosynthesis.

.....

.....

[2]

(ii) decrease net primary productivity.

.....

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.....

[3]

The table describes some of the habitat requirements of birds associated with broad-leaved woodlands.

Species	Requirements
Lesser spotted woodpecker	Feeds in canopy. Nests in dead and dying timber.
Wood warbler	Requires sparse understorey and ground vegetation.
Green woodpecker	Feeds on ants in open grassy areas in woodland. Will excavate nest in living trees.
Long-tailed tit	Feeds in glades on worms. Nests in thickets. Feeds on edges of woodland (edge habitats).
Great spotted woodpecker	Needs dead wood for drumming displays. Will excavate nests in living trees.
Jay	Secretive, needs well developed understorey. Omnivorous on ground and trees.
Sparrowhawk	Prefers large woods. Edge habitats important for hunting. Feeds on tits, finches, thrushes and occasionally pigeons.
Treecreeper	Prefers to nest in dead trees behind flaking bark. Feeds on insects.
Blackcap	Favours mature woodland with well developed understorey. Feeds on insects and berries.

(a) Using information in the table explain the following terms.

(i) interspecific competition.

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[2]

(ii) ecological niche.

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[2]

(b) Explain why bird conservation and maximum timber production may be conflicting management objectives.

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[2]

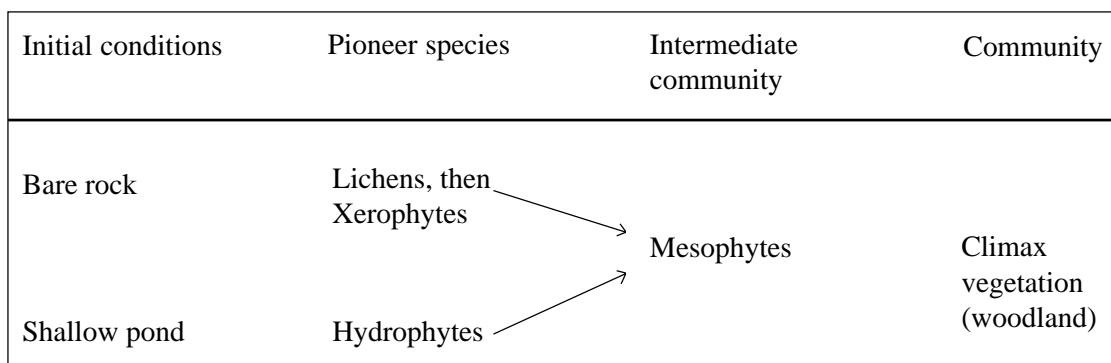
(e) Why is it important to maintain a diversity of trees within a woodland?

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.....

[2]

The diagram shows the establishment of different types of plant community and their development over time.



(a) What term describes the process shown in the diagram?

..... [1]

(b) Describe one way in which the structure of each of the following is adapted to its environment:

(i) Xerophytes:

..... [1]

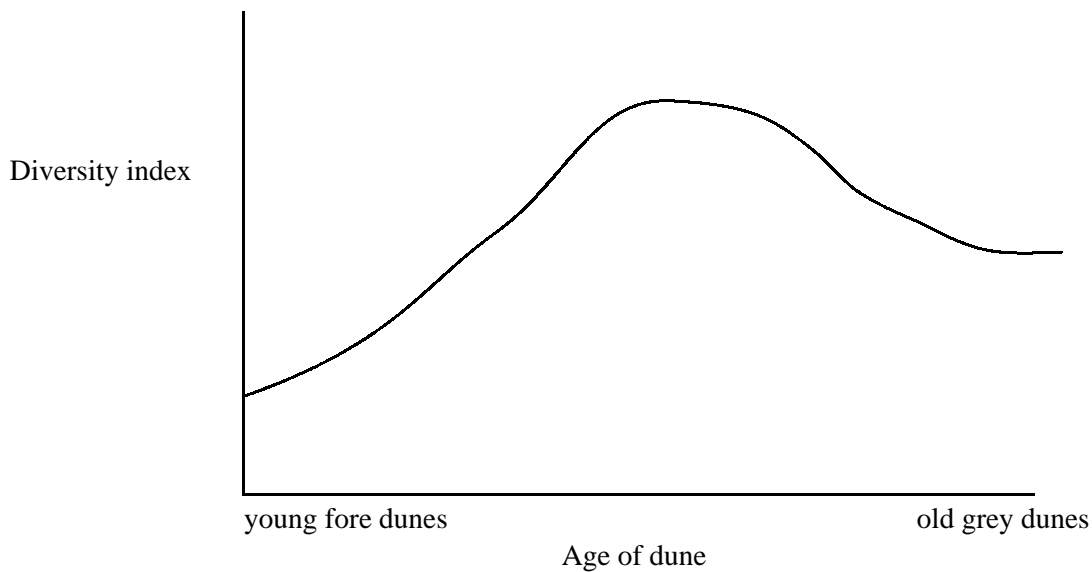
(ii) Hydrophytes:

..... [1]

(c) Outline the sequence of events by which a hydrophytic community develops into a mesophytic community such as a woodland.

..... [3]

The diagram below shows how species diversity varies with the age of sand dunes.



(a) What is meant by the term 'pioneer species'?

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.....

[3]

(b) Why is species diversity considered to be an important measure?

.....

.....

[1]

(c) Suggest one reason why species diversity often declines once the climax stage has been reached.

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[2]

(a) Define the following terms:

(i) habitat.

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.....

[3]

(ii) community.

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[3]

(iii) population.

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[3]

(b) Describe how you would perform an investigation to determine whether the frequency of lawn mowing influences the population density of plantains in a lawn.

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[6]