**Name:**

|  |  |
| --- | --- |
| **1.5 A Study of an Ecosystem** | **Objectives** |
| 1.5.1 Broad Overview of a Selected Ecosystem | 1. Present an overview of diversity of life forms in an ecosystem. |
| 1.5.2 Observation and Scientific Study of a Selected Ecosystem | 1. Identify a number of habitats from the selected ecosystem. 2. Identify five plants and animals using simple keys. 3. Identify and use various apparatus required for collection methods |
| 1.5.3 Organism Distribution | 1. Explain the difference between a Qualitative & Quantitative study for plants and animals. 2. Complete Frequency and Percentage Cover techniques. |
| 1.5.4 Choice of Habitat | 1. Correlate choice of habitat for organisms to Abiotic Factors. 2. Investigate and report on any 3 Abiotic Factors. |
| 1.5.5 Organism Adaptations | 1. Explain the necessity for and give examples of Structural / Competitive / Behavioural adaptations 2. State one adaptation by one organism in the selected ecosystem. |
| 1.5.6 Organism Role in Energy Transfer | 1. Explain and identify the role of the organism in energy transfers. 2. Draw a food chain of the study area. 3. Draw a food web of the study area. 4. Draw a food pyramid of the study area. |
| 1.5.7 Analysis | 1. Discuss the necessity for analysis and assessments of results obtained. 2. Identify local ecological issues related to selected organisms |

**Study of an ecosystem**

*Within the class each group studies a different habitat (approx. 15m2) within the ecosystem and pools results. NB = fieldwork techniques, recording and analysing data.*

1. Map
2. Identify plants and animals
3. Estimate numbers of plants and animals
4. Measure the environmental (abiotic) factors
5. Present the information.

Overview of selected ecosystem – include diversity of organisms

**1. Map** of habitat- **Simple Map/Profile Map**

* **Simple –** plan view, prepared using a baseline and measuring tape.
* **Profile** – prepared using metre sticks, a spirit level and a measuring tape.
* Mark in any distinctive physical features e.g. streams, trees, ponds, rock, paths etc. Show scale.

Observation and scientific study of ecosystem

# 2. Identify plants and animals

Use an expert, pocket guide or a key.

Follow the countryside code.

* Only collect organisms if it is absolutely necessary and you cannot identify them in the field.
* Return organisms to the habitat if possible.
* Leave the habitat as you found it.
* Beware of dangers such as deep water, thorns, stinging insects.

## Presentation of results

Draw and label 5 plants and 5 animals.

Study one in detail – include the way in which the organism gets its food (mode of nutrition). Draw reproductive parts of flower, method of pollination.

The habitat of each of the 10 organisms should be identified on the original map.

# Collecting plants and animals

Plants – break a piece off (flower and leaves) and put in labelled plastic bag.

|  |  |  |  |
| --- | --- | --- | --- |
| **Device** | **Procedure** | **Collected** | **Diagram** |
| Knife | Cut | Plants |  |
| Trowel | Dig | Plants, animals in soil |  |
| Pooter | Suck | Insects, spiders |  |
| Beating tray | Shake bushes | Insects, caterpillars, spiders |  |
| Pitfall trap | Sink into soil | Crawling insects, spiders |  |
| Sweep net | Sweep through grass | Insects |  |
| Plankton net | Sweep through water | Plankton |  |
| Tullgren funnel | Heat soil (using a lamp) | Small insects, centipedes, milipedes |  |
| Baerman funnel | Heat soil in water | Arthropods, worms from mud |  |
| Mammal traps | Set trap | Shrews, mice |  |
| Potassium permanganate solution | Pour onto soil | Earthworms |  |
| Cryptozoic trap | Place on ground | Slugs, snails, worms, woodlice |  |

3. Organism distribution – estimating organism numbers

A **qualitative study** records the presence or absence of species.

A **quantitative study** records the number of each species.

* Subjective – a personal judgement as to the number (not recommended as it may vary from person to person)
* Objective – an independent method of calculating numbers is used.

# Quantitative study

Quadrats:

* **Percentage cover** of plants or stationary animals (use % area covered in each quadrat or use a graduated quadrat :

number of touches x 100 = 10 x 100 = 40%)

number of squares 1 25 1

* **Frequency - the chances of finding a named species with any one throw of the quadrat.** (slugs found in 4 out of 16 gives a frequency of 4/16 x 100 = 25 %)

This method is fast and easy. Disadvantages: dependent on organism and quadrat size and presumes that organisms are evenly distributed throughout habitat.

Transects:

* **Line transect** (rope marked at intervals – record what touches the line and measure environmental conditions at each).
* **Belt transect** – take quadrats in a line

# Capture – recapture method

(use paint, tags, legs ringed

Number of animals – C1st x C2nd

M 2nd

Assumptions:

* Marking must not harm the animals e.g. make it more visible to predator
* Animals mix evenly in habitat (not bunched e.g. colonies of ants)
* Animals are restricted to local area
* Marked animals must be given time to mix with the unmarked population

4. Choice of habitat – measuring abiotic factors

***Three abiotic factors*** are measured. Relate results to **choice of habitat** selected by each organism (10) identified in this study.

|  |  |  |
| --- | --- | --- |
| **Sample factor** | **Measured by** | **Influence** |
| Aspect | Compass | Direction slope faces affects affect flowering, fruiting, and growth of plants due to temperature and wind exposure. |
| Soil pH | Universal indicator, pH meter | Favours some plants and therefore some animals |
| Light intensity | Light meter | Plants are adapted to different light intensities |

* Aspect –
  + Temperature (thermometer)- if south-facing it will receive more sun – warmer and brighter and therefore flowers will flower earlier that north-facing slopes.
  + Wind (anemometer & wind gauge)- Plants grow better on sheltered side.
* Soil pH:
  + Acid soil – mountain ash, gorse, holly, birch
  + Neutral/basic soil – hawthorn, ash, blackthorn, elder

Light intensity:

Light – plenty of flowering plants

Shade e.g. under laurel shrubs - ivy

Organisms show many adaptations that allow them to survive in their habitat.

5. Analysis & Presentation of results:

* Tables, lists, charts, graphs, diagrams, histograms.
* Include food chains, food webs, pyramid of numbers (identify the role of the organism in energy transfer)
* Identify local ecological issues related to the woods.
* Portfolio/Report

**Sources of errors in an ecosystem:**

* Human error - from mistakes in measuring (judgement) or recording.
* Changing conditions, both natural e.g. seasonal: autumn – summer or artificial e.g. pollution.
* Accidental discoveries maybe made – e.g. rare animal (bird of prey) may be present on a rare occasion or at night (owl) or shy animal discovered by quiet walker and not a class.
* Sample size - habitats studied may not accurately reflect the overall ecosystem if habitat is too small to include all animals and plants or of only a few habitats are studied.

(quadrats are limited by the size of species (trees too big), animals too fast)

**Organism adaptations** – may be structural, competitive or behavioural *know one*

|  |  |  |
| --- | --- | --- |
| Organism | Adaptation | Benefit |
| Primrose | Early growth and flowering | Less competition for light before leaves grow on trees |
| Ladybirds | Brightly coloured | Indicates their presence (full of formic acid!) |

**Woodland**

Organisms found in woodland. ***(know 5 plants and 5 animals)***

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vegetation** | **Invertebrates** | **Higher Predators** |
| Trees & shrubs layer | Ash, hawthorn, blackthorn, elder, holly, willow | Greenfly, caterpillars, ladybirds, spiders | Chaffinch, blue-tit, robin, sparrowhawk |
| Herb layer | Primrose, stitchwort, cow parsley, celandine | Butterflies, snails, slugs, flies, wasps, midges, bees | Blackbird, thrush, fieldmouse |
| Ground layer | Ivy, ferns, fungi, mosses | Woodlice, centipedes, beetles, millipedes | Pymgy shrew, hedgehog, badger, fox |
| Soil layer | Fungi, bacteria | Earthworms, flatworms |  |

Zonation based on light availability.

# Trees

* Shrubs whose seeds are dropped by birds – elder, wild rose, blackberry brambles
* Trees and shrubs grown from wind-dispersal of seeds – gorse, ash, sycamore
* Rarer trees and shrubs – holly, willow, hazel, lime, wych elm, oak
* Non-native plants = laurel, flowering cherries, lilac, fuschia.

# Non-woody plants

* Must flower before the leaves come on trees in order to have enough light. In Spring – lesser celandine, stitchwort, cow parsley, hogweed, goose-grass, primrose, bluebell and violet.
* Plants adapted to lower light intensities – ivy, fern, moss.
* Climbers (climb up other plants to reach light) – bindweed, honeysuckle.
* Grasses – not enough light to grow. Those present are uncut versions of those in field.

**1.5 A Study of an Ecosystem**

## Section A

**SEC Sample Paper HL**

**5.** (a) A 2.5 hectare field was surveyed for clover plants using the quadrat method.

A quadrat of side 0.5 m was used. The results of the survey are shown in the table below.



Estimate the number of clover plants in the field. (1 hectare = 10 000 m2)

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(b) A survey of field mice was carried out in the field mentioned in (a) using the capture/recapture method. The field mice were caught using small mammal traps which were set at random points in the field. Forty field mice were captured, tagged and released at their capture points. One month later the traps were again set at the same locations and forty field mice were caught. Five of these were found to be tagged. Estimate the population density of the field mice in numbers per hectare.

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**2006 HL**

**2.** Answer the following questions in relation to your study of ecology.

(b) What is meant by a qualitative survey?

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**2010HL**

**5.** Explain each of the following terms from your study of ecology.

(g) Fauna ………………………………………………………………………………..………**1.5 A Study of an Ecosystem**

## Section B

**2006 HL**

**9.** (a) (i) What is meant by the term ‘fauna’? ……………………………………………………………

(ii) In ecological studies what is a key? ……………………………………………………………

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(b) (i) Name **five** plants in the ecosystem that you have studied.

1.……….…………………………………………………………………………………….….

2.…….……………………………………………………………………………………….….

3.……….………………………………………………………………………………………..

4.……………………………………………………………………………….………………..

5.……..………………………………………………………………………………………….

(ii) In the space below draw up a simple key which could be used to identify each of these plants.

(iii) Name **five** animals in the ecosystem that you have studied.

**1.**………………………………………………………..……………………….….

**2.**…………………………………………………………………..…………….….

**3.**………………………………………………………………………..……….….

**4.**……………………………………………………………………..………….….

**5.**…………………………………………………………………………..…….….

(iv) In the space below draw up a simple key which could be used to identify each of these animals.

**2008 HL**

**7.**

(b) Answer the following questions by reference to a named ecosystem that you have investigated.

Name of ecosystem………………………………………………………………………………

(i) List **three** abiotic factors that you investigated.

1. …………………………….. 2. …………………………….. 3. ………………………..

(ii) For each of the three abiotic factors that you have listed describe how you carried out the

investigation.

Factor 1 .………………………………..………………………………………………………..

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Factor 2 ..........……………………………………… ……………………………………………

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Factor 3…………………………………………………………………………………..………

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(iii) In the case of a named organism give an adaptation feature that you noted.

Name of organism .…………………………………………

Adaptation feature …………………………………...……….…………………………….

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(iv) Briefly explain how the adaptation feature that you have given in (iii) is of benefit to the

organism. ………………………………………………………………………………….

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**2013 HL**

**7.**

(b) Answer the following questions in relation to a **named** ecosystem which you have investigated.

Ecosystem. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(i) How did you investigate a **named** abiotic factor, other than temperature or pH?

Abiotic factor. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How investigated. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(ii) How were you able to identify the animals that you found in the ecosystem?

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(iii) When conducting a quantitative survey of plants, how did you ensure that your sample was

random?

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(iv) In the case of a **named** animal **and** a **named** plant give an example of an adaptation to its

habitat that you observed.

Animal. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Adaptation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Plant. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Adaptation. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(v) As part of your study of your selected ecosystem you constructed a pyramid of numbers.

Name the species that occupied the top of your pyramid.

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(vi) What is the main prey of the species referred to in part (v)?

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**SEC Sample Paper OL**

**8.** (a) Name an ecosystem that you have studied ………………………………………………

Name **three** plants that are normally present in this ecosystem

1. ………………………….. 2. …….……….……….…. 3. …….…………………

(b) Answer the following in relation to **one** of the plants you have named in (a).

Describe how you carried out a survey to find out how many plants of this species were present in your study area.

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How did you present the results of the survey?

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Suggest **one** possible error that may affect the results of the survey

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**2004 OL**

**8.** (a) Name an ecosystem that you have studied. ……………………….…………………….

Name **three** animals that are **normally** present in this ecosystem

1. ………………………………………………………………………………..………

2. …………………………………………………………………………………………

3. …………………………………………………………………………………………

(b) Select **one** of the animals that you have named in (a) and answer the following questions in relation to it.

Which animal have you selected? ………………………………………………………

State **two** features that allowed you to identify the animal

1 …………………………………………………………………………………………

2 …………………………………………………………………………………………

Name an organism on which this animal normally feeds …………………………………………………………………………………………

Explain how you attempted to find out how many of these animals were present in the ecosystem

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Using the axes below draw a graph to show how you would expect the numbers of this animal to vary in the ecosystem in the course of a year.



**2006 OL**

**8.** (a) (i) What is meant in ecology by a **quantitative** survey?

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1. What is a quadrat frame?

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(b) (i) In the case of a **named** plant describe how you would carry out a quantitative survey in the

ecosystem that you have studied.

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(ii) Describe how you recorded the results of your survey.

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(iii) Suggest a possible source of error in your study………………………………………………………..

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**2007 OL**

**9.** a)(i) What is meant in ecology by a quantitative survey? ………………………………

………………………………………………………………………………………

………………………………………………………………………………………

(ii) What is a quadrat frame? …………………………………………………………

………………………………………………………………………………………

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(b)Answer the following questions in relation to a quantitative survey of plants that you carried out.

(i) How did you use the quadrat frame to carry out the survey? ………………………

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(ii) Why did you use a number of quadrats or use the quadrat frame a number of times?

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………………………………………………………………………………………

(iii) How did you identify the plants? …………………………………………...….......

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(iv) How did you present your results? …………………………………………............

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(v) Is the quadrat method suitable for animal populations? ……………………………

Explain your answer ……………….………………………………………………

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**2013 OL**

**9.**

(b) (i) As part of your ecosystem study, you used various pieces of apparatus to collect animals for

identification.

Draw labelled diagrams of **two** pieces of apparatus that you used to collect animals **and**

in **each** case name the apparatus and an animal collected.

Name of apparatus 1…………………………. Animal collected………………………………….

Labelled diagram of apparatus 1.

Name of apparatus 2 …………………………….. Animal collected …………………………………

Labelled diagram of apparatus 2.

(ii) Name the piece of apparatus shown.

.………………………………………………………………….…

(iii) What is this piece of apparatus used for in your ecology studies?

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**1.5 A Study of an Ecosystem**

## Section C

**2004 HL**

**10.** (c) Lemmings are small rodents that are widespread in northern latitudes. The graph shows

the fluctuations in lemming numbers in northern Manitoba between 1929 and 1943.

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[Adapted from J. P. Finerty (1980). *The Population Ecology of Cycles in Small Mammals*. Yale University Press,New Haven.]

(i) The graph indicates that population peaks occur at fairly regular intervals. What is the approximate average time between these peaks?

(ii) What is the mean maximum population density (numbers per hectare) for the period covered by the graph?

**2005 HL**

**12.** (c) (i) Give an account of how you carried out a quantitative survey of a named plant species in

an ecosystem that you have studied. In your answer describe how you recorded the results of your survey.

**2006 HL**

**10.** (b) Describe how you carried out a quantitative survey of a **named** animal in the ecosystem

that you have studied. **(27)**

**2009 HL**

**11.** (c) (i) In relation to ecological surveys, explain the meaning of the terms:

1. *Qualitative*.

2. *Quantitative*.

(ii) In the course of your ecological studies you investigated an ecosystem. Name this ecosystem and describe how you conducted a **quantitative** survey of plants present in it.

(iii) How did you present the results of your survey?

(iv) Suggest a possible source of error in your survey. **(24)**

**2010 HL**

**12.** (c) **In your answer book**, say whether **each** of the following statements is true or false **and** give a reason

for your choice in each case:

(i) Food chains are usually short.

**2011 HL**

**10.**

(c) (i) In relation to a study of an ecosystem distinguish clearly between *qualitative* and

*quantitative* surveys by writing a sentence about each.

(ii) How were you able to identify the different plants in the ecosystem that you investigated?

(iii) Describe how you carried out a quantitative survey of the major plant species.

(iv) Give **two** possible sources of error that may have arisen in the course of your survey. **(24)**

**2012 HL**

**11.**

**(27)**

(c) **Name the ecosystem** which you investigated during your study of ecology.

(i) Explain th/e terms

1. *Flora,*

2. *Fauna.*

(ii) Name **one** animal from your named ecosystem **and** describe how you carried out a

quantitative study of that animal.

(iii) Suggest **one** way in which marking an animal might endanger it.

(iv) Ecosystems are subject to changes, both natural and artificial.

Mention **one** of **each** type of change as it applies to your named ecosystem. **(24)**

**2005 OL**

**10.** (b) Animals A, B, C, D, E, F, G were found in a small lake. They are not drawn to the same

scale.

Use the following key to identify each of these animals. Write down each letter and the animal it represents in your answer book.

**(21)**

**1.** Jointed legs present …………………………………………………….………….2

Jointed legs absent ………………………………………………………..…….…3

**2. Three** pairs of jointed legs….……………………….………………..Diving beetle

**Four** pairs of jointed legs……………………..…………………………Water mite

**3**. Body divided into segments………………………………………………….. Leech

Body not divided into segments……………………………………………………4

**4.** Shell present ….………………………………………………………….Pond snail

Shell absent ………..………………………………………………………………5

**5.** Ring of tentacles around the mouth……….………………………………....*Hydra*

No tentacles………………………………………………………………..………6

**6.** Flat body with eye spots…………………………………………………..Planarian

Round body with pointed ends ………………………………………….Nematode

**2006 OL**

**10.** (a) (ii) Using organisms from the ecosystem that you have investigated draw a pyramid

of numbers to show at least **three** trophic (feeding) levels.

**2007 OL**

**10.** (c)Answer the following questions in relation to a named ecosystem you have investigated.

(i) Name the ecosystem.

(ii) Describe how you collected a **named** animal.

(iii) State one way in which a **named** organism was adapted to the ecosystem.

(iv) What is meant by an abiotic factor?

(v) Give **two** abiotic factors that you investigated.

(vi) In relation to the abiotic factors you have named, describe how you measured each one.

**2008 OL**

**10.** (b) Answer the following questions by reference to an ecosystem that you have studied.

(i) Name the ecosystem.

(ii) Name two habitats from the ecosystem.

(iii) Name an animal that is present in **one** of these habitats and describe **one** way in which it is adapted to that habitat.

(iv) Describe briefly how you carried out a quantitative survey of a **named** plant found in the ecosystem. **(27)**

**2009 OL**

**10.** (b)



(i) Distinguish between quantitative and qualitative surveys in an ecosystem.

(ii) Name the piece of equipment shown above which is used in a quantitative study of an ecosystem.

(iii) Why is the above piece of apparatus unsuitable for studying most animal populations?

(iv) Suggest a plant that would not be suitable to survey using the above apparatus.

(v) Outline how this piece of apparatus is used for studying plant populations.

(vi) How did you present your results?

(vii) State **one** possible source of error in a survey of an ecosystem. **(27)**

**2011 OL**

**11**. (b) The food web below was drawn by a group of students following their field work.

Study the web and answer the questions.



(v) What is meant by a *quantitative* survey of organisms in a habitat?

(vi) Name **two** pieces of apparatus used to collect animals from an ecosystem. **(24)**

**2012 OL**

**10.** (a) Using organisms from the ecosystem you have studied, draw a pyramid of numbers to show at least **three**

feeding levels.

**(9)**

(b) (i) All organisms in an ecosystem are influenced by biotic and abiotic factors.

Explain the underlined words.

(ii) Name any **two** abiotic factors from an ecosystem you have studied and describe how you measured

**each** one.

(iii) Keys may be used to identify animals. Use the following key to identify animals A, B and C.

The animals are not drawn to scale.



1. Animal has a shell……………………………………………………...*Helix*.

Animal does not have a shell…………………………………………..Go to 2.

2. Animal has legs …………………………………………………….…Go to 3.

Animal does not have legs…………………………………………......Go to 4.

3. Animal has three pairs of legs…………………………………………*Tribolium.*

Animal has more than three pairs of legs……………………………...*Pieris* larva.

4. Animal has long rounded body………………………………………...Nematode.

Animal has flat body with two eye spots………………………………Planarian.

(iv) All organisms are adapted to their own habitat.

1. Name **one** animal from the ecosystem you have studied.

2. Describe **one** way in which it is adapted to its habitat. **(27)**

(c) (i) Distinguish between a quantitative and a qualitative survey by writing a sentence about each.

(ii) 1. Name **one** plant from the ecosystem you have studied.

2. Describe how you carried out a quantitative survey to determine its frequency.

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