Ecology 3

Name: _____

Class: _____

Date: _____

Time: **98 minutes**

Marks: **92 marks**

Comments:

1. Human activities affect the environment.

(a) Describe the reasons why deforestation takes place and the effects deforestation has on the environment.

(6)

Forests have been called:

‘The lungs of the planet.’

(b) Describe **one** way forests being called ‘The lungs of the planet’ can be considered to be a **correct** statement.

(1)

(c) Trees do **not** have lungs.

Describe **one** other way forests being called ‘The lungs of the planet’ is an **incorrect** statement.

_____

_____

_____

(1)

(Total 8 marks)

2. Animals have adaptations to survive in their environment.

These adaptations may be structural, behavioural or functional.

(a) Draw **one** line from each animal adaptation to the type of adaptation it is.

Animal adaptation	Type of adaptation
 Male palm cockatoos use sticks to beat on hollow branches to attract females.	Structural
 The harmless hornet moth has black and yellow stripes to look like a bee or wasp.	Behavioural
 Sea spiders have automatic muscle contractions that move oxygen around their bodies.	Functional

(2)

Plants also have adaptations.

Orchid plants have adaptations which make them one of the most successful plant groups.

Orchids rely on insects for pollination.

The photograph shows an orchid.

(b) Which **two** features help orchids survive?

Tick (✓) **two** boxes.

Brightly coloured flowers	☐
Large quantities of pollen	☐
No scent	☐
Oval shaped leaves	☐
Small leaves	☐

(2)

Many orchid species grow in tropical rainforest ecosystems.

(c) What name describes the variety of all the different species found in an ecosystem?

Tick (✓) **one** box.

- Biodiversity ☐
- Evolution ☐
- Feeding relationship ☐
- Habitat ☐

(1)

(d) Some species of orchid may become extinct because of deforestation.

Give **one** reason why tropical rainforests are being cut down.

_____

(1)

(e) Give **one** factor that might cause a species of orchid to become extinct.

Do **not** refer to deforestation in your answer.

_____

(1)

Scientists have analysed the entire genetic material of one species of orchid.

(f) What chemical is the genetic material made from?

_____

(1)

(g) What is the name for the entire genetic material of an organism?

_____

(1)

(Total 9 marks)

3. There has been a rapid increase in the percentage of carbon dioxide in the atmosphere since 1960.

(a) Carbon dioxide is a greenhouse gas that contributes to global warming.

Name **one** other greenhouse gas.

_____

(1)

(b) Global warming causes climate change.

Give **two** effects of climate change.

1 _____

_____

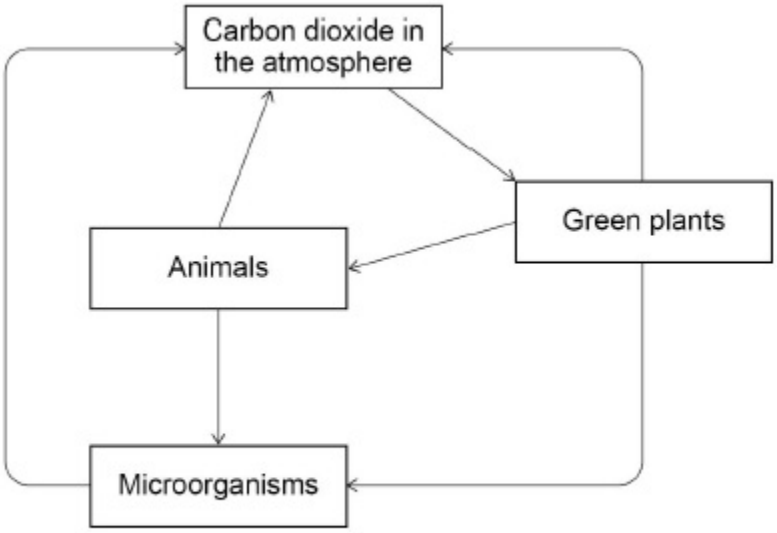
2 _____

_____

(2)

(c) Plants take in carbon dioxide from the atmosphere.

The diagram shows part of the carbon cycle.



Describe how carbon from the atmosphere is cycled through living organisms.

(6)

(Total 9 marks)

4. **Figure 1** shows a food chain in a garden.

Figure 1

(a) Which term describes the spider in this food chain?

Tick (✓) **one** box.

- Primary consumer ☐
- Producer ☐
- Secondary consumer ☐
- Tertiary consumer ☐

(1)

(b) Many of the spiders in the garden died.

What is likely to happen to the number of blackflies in the garden?

Tick (✓) **one** box.

- Decrease ☐
- Increase ☐
- Stay the same ☐

(1)

(c) Give a reason for your answer to part **(b)**.

_____

_____

(1)

The table shows the estimated biomass of organisms in the garden.

Organism	**Biomass in g**
Bean plants	225
Blackflies	115
Spiders	65
Blackbirds	10

(d) What conclusion can be made about biomass in food chains?

_____

_____

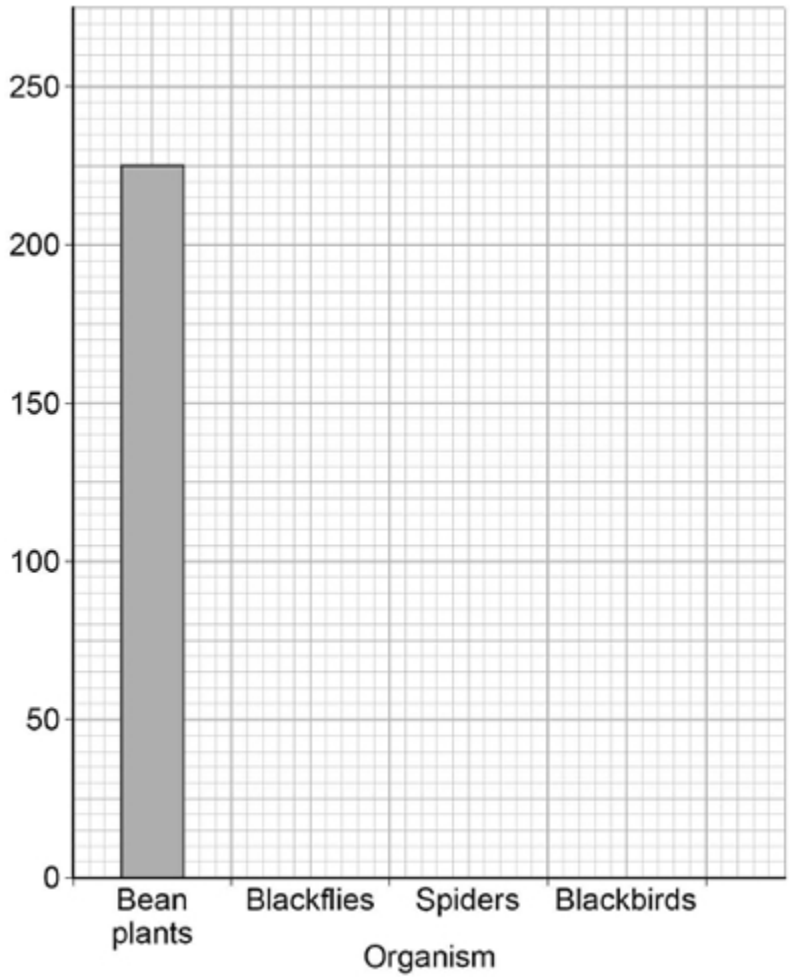
(1)

(e) Complete **Figure 2**.

You should:

- label the y-axis
- plot the data from the table above.

Figure 2



(3)

(f) Explain why a garden is **not** a stable community.

_____

_____

_____

_____

(2)

(Total 9 marks)

5. Some students estimated the population of daisies in a school field.

This is the method used.

1. Find a place where some daisies are growing.
2. Put the quadrat down.
3. Count and record the number of daisies in the quadrat.
4. Repeat steps 1–3 at four different places in the field.
5. Calculate the mean number of daisies per quadrat.
6. Use the data to estimate the total number of daisies in the field.

(a) Which **two** improvements would increase the validity of this method?

Tick (✓) **two** boxes.

Do not put any quadrats near trees. ☐

Repeat for another ten quadrats. ☐

Use a long tape measure. ☐

Use a random method to place the quadrats. ☐

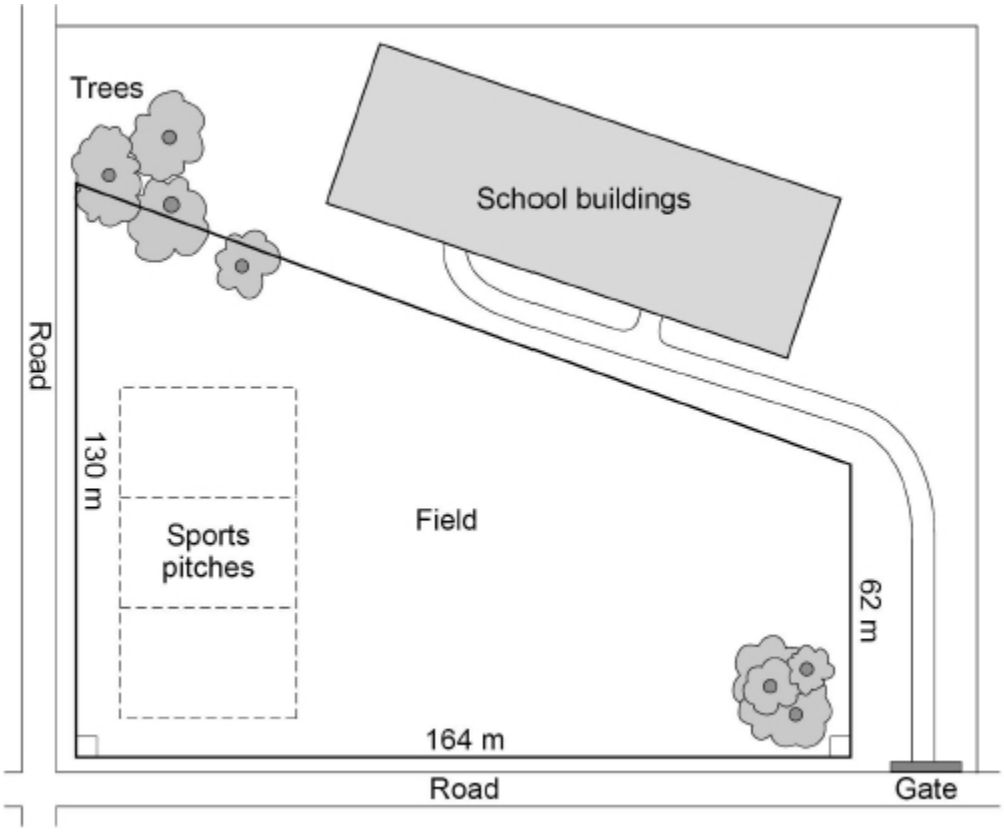
Use the same person to place all the quadrats. ☐

(2)

(b) With an improved method the students calculated the mean number of daisy plants to be 7.65 per quadrat.

The students used a quadrat measuring 50 cm × 50 cm

The diagram shows the school site and the dimensions of the school field.



Calculate the population of daisy plants on the school field.

Give your answer in standard form to 2 significant figures.

Population of daisy plants = _____

(5)

(c) The students noticed a very uneven distribution of daisy plants in the field.

Explain how different biotic factors **and** abiotic factors could have caused an uneven distribution of daisy plants.

Use the diagram above.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 13 marks)

6. A class of eight students measured the population of water fleas living at the edge of a large pond.

This is the method each student used.

1. Put some pond water in a white tray.
2. Take a pond net and scoop at the edge of the pond a few times.
3. Empty the pond net into the water in the tray.
4. Count the number of water fleas in the tray.

The photograph below shows a student working.

(a) The students did **not** control some variables.

Give **two** variables the students should have controlled to make this a valid method.

1. _____

_____

2. _____

_____

(2)

The eight students then used a different method to obtain valid results.

Table 1 shows their results.

Table 1

Student	Number of water fleas per 1000 cm^3 pond water
A	66
B	37
C	51
D	102
E	40
F	122
G	75
H	19

(b) Calculate the students' mean value for the population of water fleas at the edge of the pond.

_____

_____

Mean population = _____ water fleas per 1000 cm^3 pond water

(1)

(c) What was the range of the students' results?

Range = _____

(1)

(d) Suggest **one** reason why such a wide range of results was found.

_____

_____

(1)

(e) The teacher then sampled the centre of the pond eight times.

His mean value was 12 water fleas per 1000 cm^3 pond water.

What conclusion can you make about the distribution of water fleas in the pond?

Use the students' mean value from part **(b)** to compare with the teacher's mean value.

_____

_____

(1)

Scientists counted some different invertebrates living in a pond in 2014 and in 2016

Table 2 shows the results.

Table 2

Invertebrate species	**Number of invertebrates**	
	2014	**2016**
Bloodworms	13	48
Freshwater shrimps	24	9
Mayfly nymphs	32	0
Water snails	19	24

(f) Calculate the change in the number of bloodworms between 2014 and 2016

_____

Change = _____ bloodworms

(1)

(g) Calculate the number of shrimps in the pond in 2016 as a percentage of the number of shrimps in the pond in 2014

_____

Percentage = _____ %

(1)

(h) Invertebrate species found in a pond can be used as an indicator of the pollution level.

Table 3 shows which species can survive in different levels of pollution.

Table 3

Invertebrate species	Pollution level		
	Low	Medium	High
Bloodworms	✓	✓	✓
Freshwater shrimps	✓	✓	✗
Mayfly nymphs	✓	✗	✗
Water snails	✓	✓	✓

Key
✓ = Can survive
✗ = Cannot survive

What conclusion can you make about the change in the level of pollution in the pond between 2014 and 2016?

Give **one** reason for your conclusion.

Use the data in **Table 2** and **Table 3**

_____

_____

_____

_____

(2)

(i) Water pollution and global warming are two problems that have been caused by the rapid increase of the human population.

Suggest **two** other problems caused by the rapid increase of the human population.

1. _____

_____

2. _____

_____

(2)

(Total 12 marks)

7. Every year scientists have recorded the date when migrating birds arrived at summer breeding grounds in the UK.

The records show that for every 1 °C increase in mean global temperature, the birds arrived one day earlier.

(a) What will the birds be competing for when they arrive at their UK breeding grounds?

Tick **two** boxes.

- Eggs ☐
- Food ☐
- Light ☐
- Mates ☐
- Oxygen ☐

(2)

(b) Birds that arrive early might survive better than birds that arrive later.

Suggest **one** reason why.

_____

_____

(1)

(c) Global temperatures are increasing every year.

This is because of an increase of greenhouse gases in the atmosphere.

Name **one** greenhouse gas.

_____

(1)

(d) Global warming affects the migration of animals.

Give **one** other effect of global warming.

_____

_____

(1)

(e) Which **two** human activities cause global warming?

Tick **two** boxes.

- Burning fossil fuels ☐
- Eating vegetables ☐
- Farming cows ☐
- Turning off lights ☐
- Using too much water ☐

(2)

(f) Which gas in the atmosphere causes acid rain?

Tick **one** box.

- Carbon monoxide ☐
- Oxygen ☐
- Ozone ☐
- Sulfur dioxide ☐

(1)

(Total 8 marks)

8. In 2017, the city of Manchester began a ‘City of Trees’ project.

The city council intend to plant 3 million trees over the next 25 years.

The trees will be planted:

- to make woodlands larger
- to make new woodlands
- in parks, streets and in people’s gardens.

(a) How will the trees benefit **the people** living in Manchester?

Tick **two** boxes.

By dropping leaves on the streets in autumn. ☐

By hiding the road signs. ☐

By helping people relax in outdoor spaces ☐

By putting soot in the air. ☐

By reducing the noise pollution. ☐

(2)

(b) How will the trees benefit **the environment** in Manchester?

Tick **two** boxes.

By giving more space for car parks. ☐

By hiding old buildings. ☐

By making new habitats for plants and animals. ☐

By providing a resting place for migrating birds. ☐

By taking more oxygen out of the air. ☐

(2)

It was suggested that 360 000 trees should be planted in the first year.

(c) How many trees would still need to be planted in the remaining 24 years?

_____

Number of trees = _____

(1)

(d) If the council planted an equal number of trees in each remaining year how many would they plant each year?

_____

_____

_____

Number of trees per year = _____

(2)

The council says that planting new trees will increase biodiversity in the area.

(e) What is the definition of biodiversity?

Tick **one** box.

The arrival of new predators in an ecosystem.	☐
The evolution of new species by natural selection.	☐
The recycling of carbon in the environment.	☐
The variety of different species of organisms in an ecosystem.	☐

(1)

(f) Suggest **one other** way the council could increase biodiversity in Manchester.

_____

_____

(1)

(Total 9 marks)

9. Many biotic and abiotic factors can affect the growth of plants.

(a) Are the factors in **Table 1** biotic or abiotic?

Tick **one** box for each factor.

Table 1

Factor	Biotic	Abiotic
Diseases		
Herbivores		
Temperature		
Water		

(2)

Two students investigated the effect of light intensity on the distribution of small plants.

The plants are growing under a tree in a park.

The students made the following hypothesis:

‘As you move outwards from a tree there will be more plant growth.’

(b) Explain why the students thought their hypothesis would be correct.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) The students used two pieces of equipment.

Give the scientific name of each piece of equipment.

A square frame measuring 0.5 m × 0.5 m _____

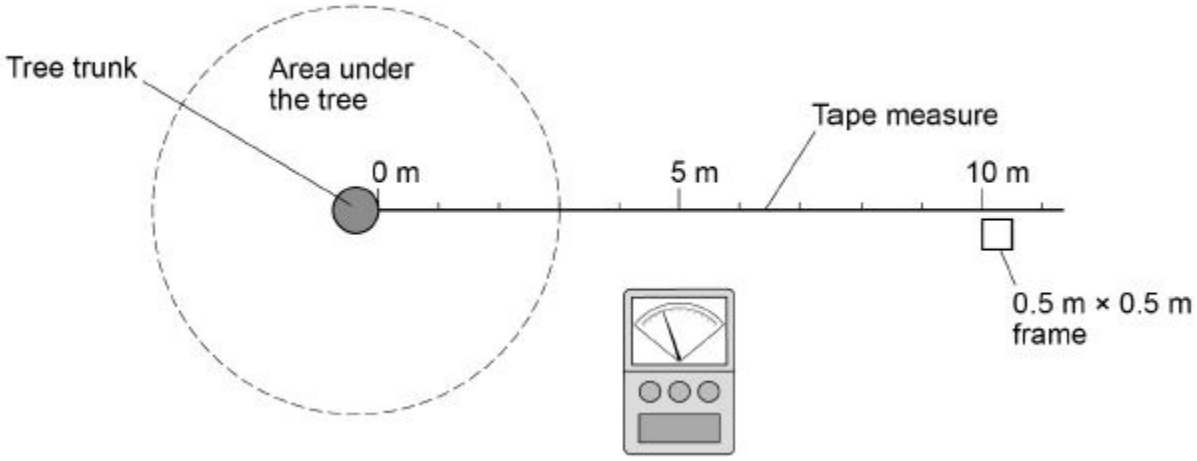
An electronic device to measure light intensity _____

(2)

This is the method used.

1. Fix one end of a tape measure at the base of the tree.
2. Fix the other end of the tape measure 11 metres from the tree.
3. At 0 metres put the square frame on the ground.
4. Identify all the plant species growing inside the frame./p>
5. Estimate and record the percentage cover of each plant species.
6. Measure the light intensity inside the frame.
7. Put the square frame on the ground every 2 metres along the tape to 10 metres.
8. Repeat steps 4 − 6 in every frame.

The diagram below shows the equipment in this investigation.



(d) Calculate the total area sampled.

_____

_____

Total area sampled = _____ m^2

(1)

(e) The whole investigation was done as quickly as possible on the same day.

Suggest **one** reason why.

_____

_____

(1)

(f) Give **one** way the investigation could be improved.

_____

_____

(1)

Table 2 shows the results.

Table 2

	Distance from tree in metres					
	0	**2**	**4**	**6**	**8**	**10**
Percentage cover of grass	15	50	35	16	15	15
Percentage cover of plantain	0	5	10	40	25	30
Percentage cover of daisy	0	0	0	4	20	10
Percentage cover of clover	1	10	25	40	40	45
Total percentage cover of plants	16	65	70	100	100	100
Light intensity in arbitrary units	37	59	150	175	>200	>200

(g) Which plant species in **Table 2** will only grow at high light intensity?

_____

(1)

(h) What conclusion can be made about the relationship between light intensity and the total percentage cover of plants?

Use data from **Table 2** in your answer.

_____

_____

_____

_____

(2)

(i) Light intensity might **not** be the cause of this pattern of plant distribution.

Suggest **one** different factor that may cause these results.

Give **one** reason for your answer.

Factor _____

Reason _____

_____

(2)

(Total 15 marks)

1. (a) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

Reasons
- tropical rainforests cleared for land
- that land used to raise cattle, plant rice or plant crops such as coffee
- land cleared for mining
- that land used to grow biofuels or palm oil
- (temperate) forests cut down for wood for building / paper
- (temperate) forests cleared for farming (wheat / sheep)

Effects
- less trees to take in carbon dioxide for photosynthesis
- decay by microorganisms respiring releases carbon dioxide
- burning waste wood releases carbon dioxide
- build-up of carbon dioxide in atmosphere leads to greenhouse effect
- build-up of carbon dioxide in atmosphere leads to global warming
- consequences of global warming
- habitat loss
- leading to reduced biodiversity
- leading to soil erosion

Must consider both reasons and effects for Level 2.

(b) (forests) involve gas exchange with the atmosphere

1

(c) (in forests) carbon dioxide is used and oxygen is released whereas in lungs it is oxygen used and carbon dioxide is released

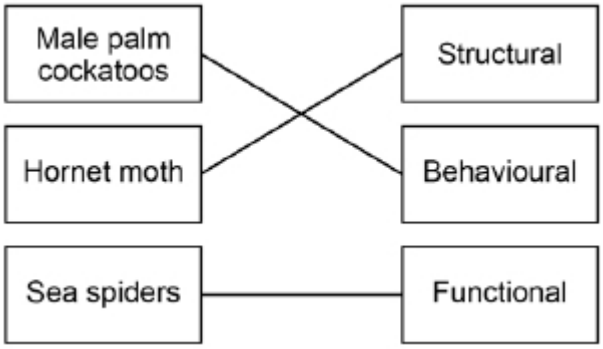
allow gas exchange occurs by diffusion in the leaves of trees, but involves ventilation / breathing in the lungs of animals

1

[8]

2.

(a)



additional lines from a box on the left negates the mark for that box

*3 lines correct for **2** marks*

*1 **or** 2 lines correct for **1** mark*

2

(b) brightly coloured flowers

1

large quantities of pollen

1

(c) biodiversity

1

(d) any **one** from:

- to grow crops

  allow farming / biofuels or named crop

- to raise cows
- to build

  *allow houses **or** building materials*

  allow mining

  allow paper / fuel

1

(e) any **one** from:

- (new) disease
- (new) herbivore

  ignore (new) predator

  allow drought / flooding

- climate change **or** global warming **or** ice age
- volcano / earthquake / tsunami / meteor
- lack of pollinators
- (new) competitor

  allow plant collectors

1

(f) DNA

allow deoxyribonucleic acid

1

(g) genome

1

[9]

3. (a) methane

*allow CH_4 **or** water (vapour) or H_2O*

allow correct example such as CFCs, nitrous oxide, ozone

1

(b)

ignore references to increased temperature and greenhouse gas / effect

any **two** from:

- ice caps melting
- rise in sea levels
- desertification
- extreme weather

allow storms or droughts or flooding

- change in species distribution
- change in migration patterns
- loss of biodiversity

allow some species become extinct / endangered

- coral bleaching
- crop failure **or** food insecurity
- loss of habitat qualified

allow correct examples such as polar bears losing ice

ignore forest fires

2

(c) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

Photosynthesis

- (carbon dioxide is) taken in through stomata / leaves
- (carbon dioxide is) used in photosynthesis
- to make glucose / carbohydrate
- (glucose used) to make other carbon compounds or named example such as proteins, lipids
- (glucose) stored as starch

Feeding
- plants are eaten / consumed by animals
- which use the carbon compounds to make other carbon compounds

Decay
- when plants / animals die they are decomposed / decayed
- by microorganisms
- which use the carbon compounds to make other carbon compounds

Respiration
- plants / animals / microorganisms respire
- (respiration) releases carbon dioxide back into the atmosphere

Level 2 answers must consider photosynthesis and at least one other process in the carbon cycle.
Level 2 answers must include some accurate detail.

[9]

4. (a) secondary consumer

1

(b) increase

1

(c)

view with part (b)

(because) the blackflies are not being eaten

allow idea of other predators (of blackflies) if 'stay the same' selected in part ***(b)***

1

(d) biomass decreases as you go up / along the food chain

allow converse

1

(e) label biomass in g(rams)

1

three bars plotted correctly

allow ± half small square

*allow **1** mark for 2 bars correct*

ignore width and spacing of bars

2

(f) organisms / species are always being added / removed

allow example of an environmental change e.g. gardener did not water for a month

1

so population sizes not (fairly) constant

1

[9]

5. (a) repeat for another ten quadrats

1

use a random method to place the quadrats

1

(b)

*an answer of 4.8 x 10^5 scores **5** marks*

*an answer of 481 766.4 **or** 481 766 **or** 480 000 scores **4** marks*

*an answer of 15 744 × 4 × 7.65 scores **3** marks*

*an answer of 15 744 (m^2) scores **2** marks*

(area of field =) 62 × 164 + 164 × 68 ÷ 2 **or** equivalent

1

15 744 (m^2)

1

15 744 × 4 × 7.65

allow use of incorrect area

allow $\frac{7.65}{0.25} \times 15744$

1

- 481 766.4

  *allow 481 766 **or** 480 000*

1

- 4.8 × 10^5

  allow incorrect calculation expressed correctly

1

(c) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

- trees over / in field
- (which) reduce light for photosynthesis
- (so) fewer daisies there

- trees over / in field
- (which) take water / nitrates / ions from the soil
- (so) fewer daisies there

- trampling on sports pitches
- (will) kill plants
- (so) fewer daisies there

- competition from plants / grasses on field
- (will) use up water / nitrates / ions / space
- (so) fewer daisies there

- gardener may water / fertilise / mow field
- (which provides) more water / nitrates / ions
- (so) more / fewer daises grow there

- more insects / disease / animals in some areas
- (may) eat / kill plants
- (so) fewer daisies there

- school buildings
- (which) reduce light for photosynthesis
- (so) fewer daisies near school

- pollution / toxins from vehicles on roads
- (which will) reduce growth
- (so) fewer daisies near roads

- wrong pH **or** lack of ions **or** poor drainage **or** poor / wet / dry soil in some areas
- (which will) slow growth
- (so) fewer daisies there

Level 3 answers must refer to several factors in accurate detail

[13]

6.

(a) any **two** from:

- (same) number of scoops / sweeps each time

  allow any idea of controlling sweeps e.g. for same time

- scoop / sweep (at same) distance from the edge of pond

  allow scoop / sweep at the same place

- scoop (at same) depth

- (same) size of net

- (same) gauge / mesh size of net

2

(b) 64

1

(c) 19 to 122

allow 122 to 19
or
103

1

(d) water fleas were not evenly spread (around the edge of the pond)

allow any description of this such as more water fleas near the vegetation

1

(e) more water fleas live near the edge of the pond

allow more water fleas live where there is vegetation

*allow converse if student's calculated answer to part **(b)** was less than 12*

1

(f) 35

1

(g) 37.5 (%)

allow 38 (%)

1

(h) there was a high(er) level of pollution (in the pond in 2016)

1

because there are no / fewer mayfly nymphs
or
because there are fewer freshwater shrimps

data must be comparative

1

allow converse for 2014

(i) any **two** from:

- famine / food insecurity
- water shortage
- landfill sites filling up
- acid rain
- deforestation / habitat destruction
- extinction of species

  or

  reducing biodiversity
- natural resources running out

ignore global warming and any water pollution references such as sewage or eutrophication

2

[12]

7. (a) food

1

mates

1

(b) any **one** from:

allow converse for late arrivals

(early arrivals)

- get more food
- get the healthiest mates

allow more likely to get a mate

- more space / material for nests
- chicks will hatch earlier and have more time to mature
- less competition
- more resources

1

(c) any **one** from:

allow correct chemical formulae

- carbon dioxide
- methane

allow water vapour, nitrogen oxides, CFCs, ozone
ignore water

1

(d) any **one** from:

- rising sea levels
- examples of climate change

  e.g. flooding, drought, desertification, melting ice caps, storms / hurricanes

- extinction of some species
- habitat loss

  ignore references to temperature

1

(e) burning fossil fuels

1

farming cows

1

(f) sulfur dioxide

1

[8]

8. (a) by helping people relax in outdoor spaces

1

by reducing the noise pollution

1

(b) by making new habitats for plants and animals

1

by providing a resting place for migrating birds

1

(c) 2 640 000
or
2.64×10^6

1

(d) 2 640 000/24 or $\frac{2.64 \times 10^6}{24}$

1

110 000
or 1.1×10^5

*an answer of 110 000 or 1.1×10^5 scores **2** marks*

*allow **1** mark for answer to part (c) divided by 24*

1

(e) the variety of different species of organisms in an ecosystem

1

(f) any **one** from:

- plant different types of plants

  allow plant wildflowers
- ask zoo to breed endangered animals for the woodlands
- reintroduction of plants or animals that no longer live in Manchester
- protect the woodland habitats

  allow sensible way to do this
- plant hedgerows on the edge of city / in parks
- not using landfill / recycling waste
- ban on cutting down trees
- sensible suggestion to reduce pollution levels

1

[9]

9. (a)

Factor	**Biotic**	**Abiotic**
Diseases	✓	
Herbivores	✓	
Temp		✓
Water		✓

*allow **1** mark for 2 or 3 correct*

2

(b) (leaves block light near tree so) more light (as you move outwards)

allow low light intensity under tree
ignore Sun

1

for photosynthesis

allow less photosynthesis under the tree

1

(which) produces (more) glucose / proteins (for growth)

ignore growth
ignore food

allow molecules, cell components or other correct substances instead of proteins

if no other mark awarded allow less water / ions / minerals / nutrients under the tree

1

(c) quadrat

correct spelling only

1

light meter

allow lux meter
allow light intensity meter
allow light data logger

1

in this order

(d) 1.5(0) (m^2)

allow 15 000 cm^2

1

(e) to keep light (intensity) as similar as possible

allow the light (intensity) might change

ignore references to temperature
ignore weather
ignore Sun

1

(f) any **one** from:

- repeat (investigation) around the tree

  allow repeat in different directions

- repeat (investigation) for other trees / areas
- sample every one metre
- count the number of each species present (rather than percentage cover)

ignore repeats unqualified
ignore repeat at different times / days / seasons
ignore different size quadrat
ignore random sampling

1

(g) daisy

1

(h) as light (intensity) increased so did the percentage / cover of plants

ignore directly proportional
ignore positive correlation unqualified

1

up to 100% / maximum at 175 (arbitrary units)

ignore distance

1

(i) any pair from:

- (lack of) water / rain (1)

  because the leaves are stopping the rain
  or
  because the roots of the tree are absorbing it (1)

  allow soil moisture

- (lack of) minerals / ions (1)

  allow magnesium / nitrate / nutrients

  because the tree (roots) have absorbed them (1)

- temperature (1)

  allow too cold / cooler

  because less thermal energy from the sun is reaching under the tree canopy (1)

  allow 'heat' for thermal energy

  allow pH / acidity (1)
  because (some) fallen leaves are acidic (1)

  2

  ignore carbon dioxide
  *do **not** accept oxygen*

[15]