Section 18 – Adaption and organisation in an Ecosystem

Answer Key

18.1	What is an ecosystem?	The Interaction of a community with the abiotic parts of the environment
18.2	What do **organisms need to survive** and reproduce?	**Water, food, light, space, oxygen, carbon dioxide, mates**
18.3	State 4 things that a plant competes for.	Water, space, light, carbon dioxide
18.4	State 3 things that an animal competes for.	Food, sexual mates, territory
18.5	Describe the differences between **biotic and abiotic factors** (give an example of each)	**Abiotic** is a non-living factor such as temperature or carbon dioxide. **Biotic** is a living factor such as predator or disease.
18.6	What is an extremophile?	(micro)organisms that live in environments that are very extreme (e.g. High temp, pressure, salt concentration)
18.7	Write a 4-stage food chain and label the producer, secondary consumer, herbivore, carnivore and omnivore.	Example must start with a plant (producer). Followed by an organism that eats the plant (primary consumer), followed by a secondary consumer then a tertiary consumer.
18.8	Describe the difference between a predator and its prey.	Predator is an animal that eats prey. Prey is the animal that gets eaten.
18.9	What is biodiversity?	A measure if the variety of all the different species of organisms within the ecosystem
18.11	**State 2 methods to determine the distribution and abundance of species in an ecosystem.**	**Random sampling using quadrat Systematic sampling using a transect**
18.12	What are the differences between random and systemic sampling?	**Random** sampling can be used to measure the distribution of one organism over a large area, **Systemic** sampling can be used to see how the distribution of organisms change across one or more habitats

Section 19 – Cycles

Answer Key

19.1	Name 3 substances that can be recycled in our atmosphere?	**Carbon, nitrogen and water**
19.2	State 3 process that return carbon dioxide to the atmosphere	**Respiration, combustion, decomposition**
19.3	What uses carbon dioxide from the atmosphere?	Plants
19.4	Where does fresh water for the plants and animals come from?	Ice sheets, ice caps, glaciers, bogs, ponds, lakes, rivers, streams and underground
19.5	State **3 factors that affect the rate of decay** of biological material.	Availability of oxygen, temperature and moisture levels
19.6	How do humans affect the amount of land for animals and plants?	Reduce the amount of land deforestation for farming, agriculture or building.
19.7	What is a peat bog?	Very wet areas of land without trees and where many types of moss grow. There are acidic and often have very low levels of nutrients. Lots of partially decayed organic material.
19.8	Why are peat bogs being destroyed? What is the impact of this?	To use as fuels or for agriculture. The impact is that when they are destroyed, they no longer take in large amounts of carbon and store it so contribute to the greenhouse effect and increased carbon dioxide levels.
19.9	As population increases what is happening to a) resources and b) amount of pollution?	A) Resources are decreasing B) Pollution is increasing
19.10	How is water, air and land polluted?	Water – litter, fertiliser, chemicals, pesticides Air – Greenhouse gases, carbon dioxide, particulates Land – litter, toxic chemicals
19.11	What is the impact of pollution on biodiversity?	Reduces biodiversity
19.12	Why is the reduction in biodiversity concerning?	Reduced genetic diversity in organisms, can lead to the extinction of species

Section 20 - Biodiversity

20.1	Give 3 causes to deforestation.	1. Provide land for cattle or rice fields 2. Grow crops for biofuels 3. To clear space for building
20.2	Which **2 gasses are increasing in the atmosphere that are contributing to global warming**?	1. **Carbon dioxide** 2. **Methane**
20.3	State **3 consequences of Climate** change.	1. Increased spread of pathogens 2. Affecting migration patterns of animals 3. Melting of polar ice caps, causing flooding 4. Reduced habitats in polar regions 5. Reduced Biodiversity
20.4	State 3 positives and 3 negatives about human interaction in an ecosystem.	POSITIVE 1. Breeding programme for endangered species 2. Protection of regeneration of rare habitats 3. Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop 4. Reduction of deforestation and carbon dioxide emissions by some governments 5. Recycling resourcing rather than dumping waste NEGATIVE 1. Clearing of land for agriculture buildings and/or transport 2. Hunting of rare species 3. Mining from the land
20.5	What is a trophic level?	The position a species occupies in the food chain.
20.6	What type of organisms are found in a trophic Level 1?	Plants and Algae
20.7	What group of organisms break down dead, organic materials?	Decomposers (microorganisms)
20.8	What do pyramids of biomass represent?	The relative amount of biomass in each level of food chain
20.9	Approximately how much light is absorbed by plants?	1% - 2%
20.10	State 2 ways in which biomass is lost through the food chain.	1. Not all the ingested material is absorbed, some is egested as faeces 2. Some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water in urea and urine
20.11	Approximately how much energy is transferred between each trophic level?	10%
20.12	What is global dimming?	Global dimming is defined as the decrease in the amounts of solar radiation reaching the surface of the Earthy

# Section – Food Production and Farming (Triple Content)

Answer Key

1.	What is compost?	Decayed organic material used as a fertilizer for growing plants.
2.	Why is compost used?	Builds good soil structure; enables soil to retain nutrients, water, and air; protects against drought; helps maintain a neutral pH, and protects plants from many diseases commonly found in the garden. It also feeds earthworms and other microbial in the soil.
3.	What does **anaerobic decay** release?	**Methane and Carbon dioxide**
4.	What is food security?	The state of having reliable access to a sufficient quantity of affordable, nutritious food.
5.	What biological factors affect food security?	Lack of land/space Increase in human population Pests/pathogen
6.	How can efficiency of food production in animals be increased?	Prevent animals from moving too much, provide food containing supplements to help growth and resistance to disease, optimum temperatures.
7.	How can efficiency in food production in plants be increased?	Crop rotation, pesticides, herbicides, fertilizers
8.	How can we maintain fish stocks?	Setting fish quotas, restrictions of types of fish to catch, limit mesh size of nets.
10.	What is eutrophication?	Hyper – nutrition resulting in fertilizer pollution of aquatic ecosystems
11.	What is intense farming?	Methods of farming which maximise food production despite negative impacts.
12.	Why might people be against intensive farming?	Reduces biodiversity, harmful to humans, harmful to organisms, build-up of poisons in a food chain, increases risk of disease, lower quality product

Foundation Tier

Q1.

Scientists are very concerned about the changes in concentration of carbon dioxide in the Earth's atmosphere.

The graph below shows the concentration of carbon dioxide in the atmosphere between 1988 and 2014.
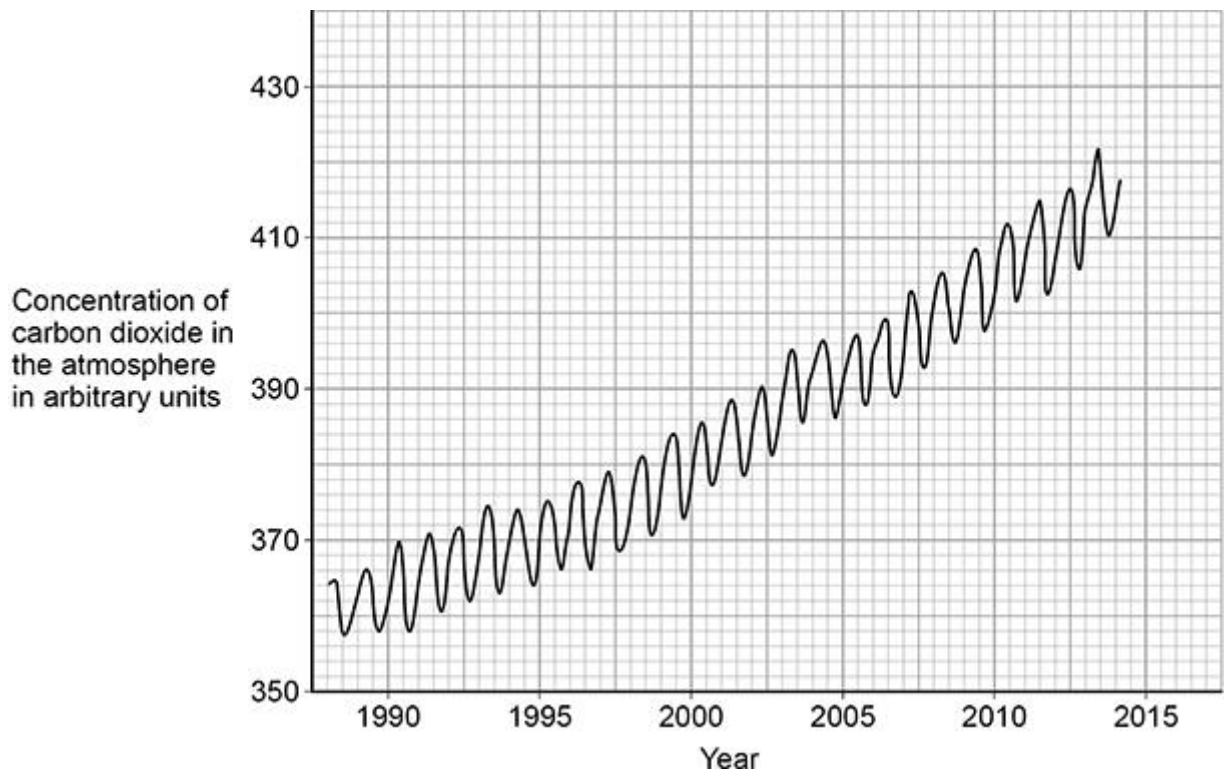
(a) Describe **two** patterns shown in the graph above.

Use data from the graph above in your answer.

1 _____

_____

_____

2 _____

_____

_____

_____

(4)

(b) Give **two** human activities that affect the concentration of carbon dioxide in the atmosphere.

1 _____

_____

2 _____

_____

(2)

(c)   The trend shown in the graph above may continue for many years.

Explain what effect the changing concentration of carbon dioxide in the atmosphere could have on living organisms.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)
(Total 10 marks)

Q2.

Decay occurs in a compost heap.

The figure below shows a compost heap.

Describe:

• how microorganisms in the layers of soil help to recycle chemicals in the dead plants
• how the chemicals are used again by living plants.

_____

_____

_____

_____

_____

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_____

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_____

_____

_____

(Total 6 marks)

Q3.

(a)   The diagram shows the carbon cycle.
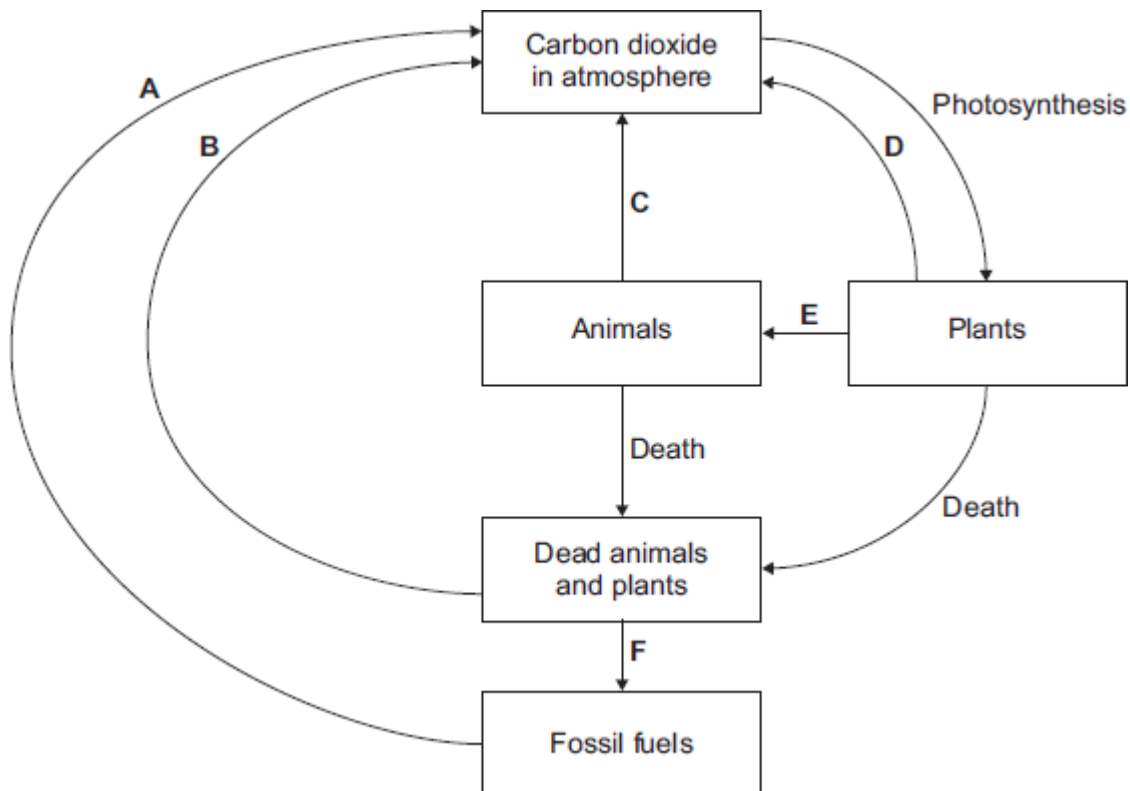
(i) The concentration of carbon dioxide in the atmosphere has increased over the last 100 years.

Give **two** human activities that might have caused this increase.

1. _____

2. _____

(2)

(ii) Give the letters of **two** arrows in the diagram which show respiration.

☐ and ☐

(2)

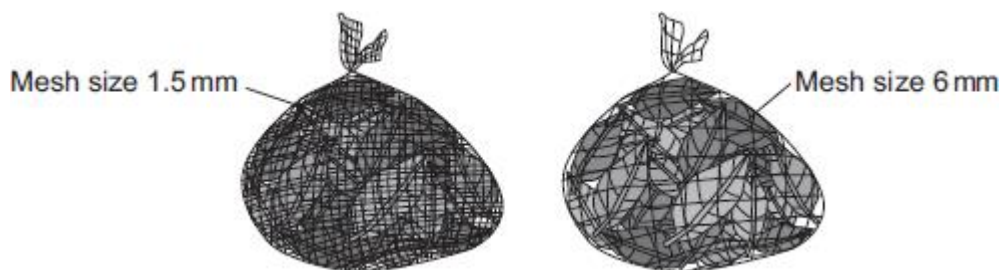(iii) Give the letter of **one** arrow which shows decay.

☐

(1)

(b) Scientists investigated the breakdown of dead leaves.

The scientists:

• placed dried leaves in mesh bags. Half of the bags had a mesh size of 1.5 mm; the others had a mesh size of 6 mm.

Mesh bags containing leaves

Mesh size 1.5 mm

Mesh size 6 mm

The scientists then:

•   weighed the dried leaves in each bag at the start of the investigation

•   placed the bags of leaves on soil: some of the bags were placed in areas where there **were earthworms** in the soil; the other bags were placed in areas where there were **no earthworms**

•   left the bags for four months

•   collected the bags, dried the leaves and weighed them again.

Most earthworms are between 3 mm and 6 mm in diameter.

The bar graph shows the scientists' results.
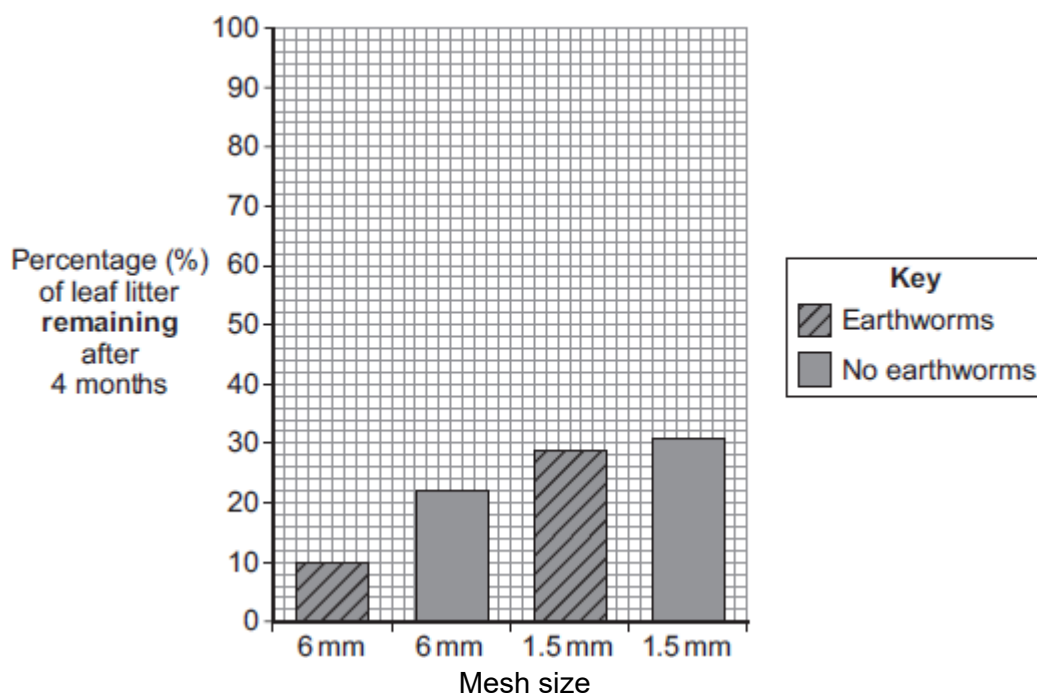
(i)   The percentage of leaf litter at the start of the investigation was 100% in each bag.

What percentage of the leaf litter was broken down in the 6 mm mesh bags . . .

with earthworms   _____ %

without earthworms?   _____ %

(2)

(ii)   What effect do earthworms have on the amount of leaves broken down in the 6 mm mesh bags?

Use your answer to part **(b) (i)** to show how you arrive at your answer.

_____

_____

_____

_____

(1)

(iii)   When there were earthworms in the soil, the results for the 6 mm mesh bags were different from the results for the 1.5 mm mesh bags.

Explain why.

_____

_____

_____

_____

(2)

(iv)   Other organisms, smaller than earthworms, cause most of the breakdown of the leaves.

Explain how the results show this.

_____

_____

_____
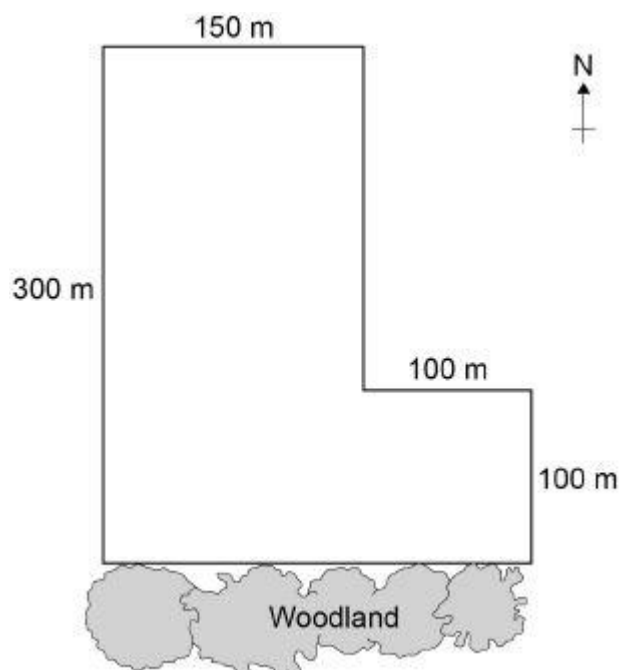
_____

_____

_____

(2)
(Total 12 marks)

Higher Tier

Q4.

Some students investigated the size of a population of dandelion plants in a field.

The diagram below shows the field.

The students:

* placed a 1 m × 1 m square quadrat at 10 random positions in the field
* counted the number of dandelion plants in each quadrat.

The table below shows the students' results.

Quadrat number	Number of dandelion plants
1	6
2	9
3	5
4	8
5	0
6	10
7	2
8	1
9	8
10	11

(a) Why did the students place the quadrats at random positions?

_____

_____

(1)

(b)   Estimate the total number of dandelion plants in the field.

Calculate your answer using information from the diagram and the table above.

Give your answer in standard form.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Total number of dandelion plants = _____

(5)

Quadrats **5**, **7** and **8** were each placed less than 10 metres from the woodland.

These quadrats contained low numbers of dandelion plants.

The students made the hypothesis:

'Light intensity affects the number of dandelion plants that grow in an area.'

(c)   Plan an investigation to test this hypothesis.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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_____

_____

_____

_____

(6)

(d)   Light is an environmental factor that affects the growth of dandelion plants.

Give **two** other environmental factors that affect the growth of dandelion plants.

1. _____

2. _____

(2)
(Total 14 marks)

Q5.

Cows are reared for meat production.

The cows can be reared indoors in heated barns, or outdoors in grassy fields.

The table shows energy inputs and energy outputs for both methods of rearing cows.

kJ / m² / year		
Energy input		Energy output
Food	Fossil fuels	Meat production
Indoors 10 000	6 000	40
Outdoors 5 950	50	X

(a)   The percentage efficiency for rearing cows **outdoors** is 0.03%

Calculate the energy output value **X**.

Use the equation:

$$\text{percentage efficiency} = \frac{\text{energy output}}{\text{total energy input}} \times 100$$

_____

_____

_____

_____

_____

Energy output value **X** = _____ kJ / m² / year

(3)

(b)   The percentage efficiency for rearing cows **outdoors** is 0.03%

Calculate how many times more efficient it is to rear cows indoors than to rear cows outdoors.

Use the equation from (a).

_____

_____

_____

Answer = _____ times

(3)

(c)   A large amount of energy is wasted in both methods of rearing cows.

Give **two** ways in which the energy is wasted.

1. _____

_____

2. _____

_____

(2)

(d)   Suggest **two** reasons why it is more efficient to rear cows indoors than to rear cows outdoors.

1. _____

_____

2. _____

_____

(2)
(Total 10 marks)

Mark schemes

Q1.

(a)   (overall) increase (in concentration of CO_2)

1

(overall increase) by 54 (arbitrary units)
> allow in range 45 to 65 (arbitrary units)

or
from 364 to 418 (arbitrary units)
> allow from 357 to 422 (arbitrary units)
> allow other correct data

1

peaks and troughs
> allow description

1

each cycle is 1 year

or
variation per cycle is 8 to 16 (arbitrary units)
> allow multiples such as 5 cycles every 5 years
> allow answer in range 8 to 16 (arbitrary units)

1

(b)   combustion
> allow a named example such as burning (named) fuels
> **or** driving cars
> **or** power stations
> ignore factories unqualified

1

deforestation
> allow a description
> allow human activities that decrease carbon dioxide concentration such as tree-planting **or** growing crops
> if no other mark awarded allow respiration for **1** mark

1

(c)   **Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

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

- (higher CO_2 concentration causes) global warming

- plants photosynthesise faster
  - due to more CO_2
  - due to higher temperature

- temperature rise causes changes in rainfall patterns **or** extreme weather conditions such as storms

- less rainfall causes desertification
  - many plant species die out
  - many animal species lack food and die
  - other (drought-adapted) plants become more common

- more rainfall causes flooding
  - loss of habitat
  - may lead to extinction

- temperature rise melts (polar) ice caps **or** glaciers
  - causes flooding
  - loss of habitat
  - may lead to extinction

- changes in animal / bird migration patterns / times **or** changes in distribution of animals

[10]

Q2.

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

in microorganisms
- digestion **or** large molecules to small molecules
- enzymes **or** named example
- respiration
- production of carbon dioxide
- release of mineral ions **or** named example such as nitrate / phosphate / magnesium

in plants

- carbon dioxide (from air) taken in by leaves
- by diffusion
- via stomata
- carbon dioxide used in photosynthesis
- making glucose / sugar / starch / cellulose **or** making other correctly named example

- (named) ions taken in by roots
- by active transport
- nitrate ions for making amino acids / proteins / DNA / chlorophyll
- phosphate for making DNA

For **Level 2** processes in microorganisms and in plants should be considered

[6]

Q3.

(a) (i) any **two** from:

- burning (fossil) fuels / one named example
  allow combustion / driving cars
  accept breathing
- deforestation / described
  *do **not** allow power stations unqualified*
- destruction of peat bogs

2

(ii) any **two** from:

B, C, D
  in any order

2

(iii) B

1

(b) (i) with worms: 90

1

without worms: 78

1

(ii) increase

1

(iii) 6 mm mesh is large enough to let (more / bigger) worms in
  allow converse for 1.5 mm mesh

1

worms entering increased breakdown

or ate more leaves

1

(iv) breakdown occurs with 1.5 mm mesh (which is smaller than worms)

1

breakdown with no worms ≈ 70% / ≈ 30% remaining

allow a lot / most breakdown without worms

accept approximate figures

1

[12]

Q4.

(a) there is an uneven distribution of dandelions
or
(more) representative / valid
or
avoid bias
or
more accurate / precise mean

ignore accurate / precise unqualified
ignore repeatability / reproducibility /
reliability / fair test

1

(b) (correct mean per m^2 =) 6 or 6.0

1

(correct field area =) 55 000 (m^2)

1

mean × area − e.g. 6(.0) × 55 000

allow incorrect calculated values for
mean and / or field area

1

330 000

allow correct calculation from previous
calculation

1

3.3×10^5

allow calculated value in standard form

1

*an answer of 3.3×10^5 scores **5** marks*
*an answer of 330 000 scores **4** marks*

(c) **Level 3:** The method would lead to the production of a valid outcome.
All key steps are identified and logically sequenced.

5−6

Level 2: The method would not necessarily lead to a valid outcome.
Most steps are identified, but the method is not fully logically
sequenced.

3−4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1−2

No relevant content

0

Indicative content

- placing of quadrat
- large number of quadrats used
- how randomness achieved − e.g. table of random numbers **or** random number button on calculator **or** along transect
- quadrats placed at coordinates **or** regular intervals along transect
- in each of two areas of different light intensities **or** transect running through areas of different light intensity
- for each quadrat count number of dandelions
- for each quadrat measure light intensity
- compare data from different light intensity

to access **level 3** the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome

(d)   any **two** from:
- temperature
    allow heat

- water
    allow moisture / rain

- (soil) pH
    allow acidity

- minerals / ions
    *allow e.g. magnesium ions **or** nitrate*
    allow salts / nutrients

- winds
- herbivores
    allow trampling
    ignore carbon dioxide
    ignore space
    ignore competition unqualified
    *do **not** accept oxygen*

2

[14]

Q5.

(a) $0.03 = \dfrac{\text{output}}{5950 \div 50} \times 10$

*an answer of 1.8 scores **3** marks*

1

$$output = \frac{0.03 \times (590 + 50)}{100}$$

1

1.8

1

1

(b)   indoor % efficiency $= \dfrac{40}{10000 + 6000} \times 100$

1

or

$\dfrac{40}{16000} \times 100$

0.25(%)

*an answer of 8.33 scores **3** marks*

allow 8 / 8.3 / 8.333...

1

$\left(\dfrac{0.25}{0.03} = \right) 8.33$ (times)

1

(c)   any **two** from:
- in faeces / egestion
  or
  not all food is absorbed
- not all food is ingested
- in urine / excretion
- in respiration
- keeping warm
- movement

  *do **not** accept 'for respiration'*

  allow as 'heat'

2

(d)   warmer indoors so less energy wasted in keeping warm

  allow less energy lost as 'heat'

1

less movement indoors so less energy wasted

  *if no other mark awarded, allow it is warmer and there is less movement indoors for **1** mark*

1

[10]