Mark schemes

1

(a) snail
or
shrew

additional incorrect answer negates correct answer

1

(b) shrew

additional incorrect answer negates correct answer

1

(c) fewer shrews to eat them

1

(d) population

1

(e) **C**

1

(f) (11 000 × 0.1 =)
1 100 (kJ)

1

(g) the snails do not eat the roots of the lettuces

1

(h) any **one** from:
- light (intensity)
- temperature
- moisture (levels)
- soil pH
- mineral / ion content (of soil)
- wind intensity / speed

  ignore wind direction
- carbon dioxide (levels)
- oxygen (levels)

1

[8]

2

(a) measure the length / area of the field

1

(b) use (a) random number(s) (generator)
or
use coordinates method explained

1

(c) compare their results with another student's results

1

place more quadrats

1

(d) 0.25 × 5 = 1.25

1

500 / 1.25 = 400

1

(40 × 400 =) 16 000

*allow 16 000 with no working shown for **3** marks*

1

(e) 11

1

(f) (quadrat) 5

*both quadrat number and correct reason must be given for **1** mark*

1

very few or only 2 growing (here)

[9]

3 (a) methane is produced

ignore bad smell

1

which is a greenhouse gas / causes global warming

1

(b) (9.80 / 0.20 = 49 therefore) 49:1

1

(c) horse (manure)

*allow ecf from **11.2***

closest to 25:1 (ratio)

1

(d) **Level 3 (5–6 marks):**
A detailed and coherent explanation is given, which logically links how carbon is released from dead leaves and how carbon is taken up by a plant then used in growth.

Level 2 (3–4 marks):
A description of how carbon is released from dead leaves and how carbon is taken up by a plant, with attempts at relevant explanation, but linking is not clear.

Level 1 (1–2 marks):
Simple statements are made, but no attempt to link to explanations.

0 marks:
No relevant content.

Indicative content

statements:
- (carbon compounds in) dead leaves are broken down by microorganisms / decomposers / bacteria / fungi
- photosynthesis uses carbon dioxide

explanations:
- (microorganisms) respire
- (and) release the carbon from the leaves as carbon dioxide
- plants take in the carbon dioxide released to use in photosynthesis to produce glucose

use of carbon in growth:
- glucose produced in photosynthesis is used to make amino acids / proteins / cellulose
- (which are) required for the growth of new leaves

6

(e) any **three** from:
(storage conditions)
- (at) higher temperature / hotter
- (had) more oxygen
- (had) more water / moisture
- (contained) more microorganisms (that cause decay)

allow reference to bacteria / fungi / mould

3

[13]

4 (a) wear a face mask

allow wear gloves

1

(b) **Level 2 (3–4 marks):**
A detailed and coherent plan covering all the major steps. It sets out the steps needed in a logical manner that could be followed by another person to produce an outcome which will address the hypothesis.

Level 1 (1–2 marks):
Simple statements relating to steps are made but they may not be in a logical order. The plan may not allow another person to produce an outcome which will address the hypothesis.

0 marks:
No relevant content.

Indicative content

Plan:
- cut a specified number of pieces of bread to the same size
- place mould spores on the bread
- the number of mould spores needs to be the same quantity of mould spores on each piece of bread
- place bread in different sealable plastic bags
- place in different temperatures (minimum of three) eg fridge, room, incubator
- leave each for the same amount of time eg four days
- measure the percentage cover of mould on each piece of bread
- repeat experiment

additional examiner guidance:
- good level 2 answer will describe how the growth of mould can be measured and will give a range of different temperatures to be used
- allow equivalent levels of credit for alternative methodologies that would clearly produce a measurable outcome in terms of mould growth at various temperatures

4

(c) any **one** from:
- type of mould
- amount of mould (put on each piece of bread)
- amount of air in the plastic bags
- size of the pieces of bread
- type of bread
- amount of moisture / water added

1

(d) (56 − 4 = 52) / 5

1

10.4

*allow 10.4 with no working shown for **2** marks*

1

*ecf for incorrectly read figures for **1** mark*

(e) (decomposition occurs at a faster rate when the temperature is higher
or
amount of decomposition is higher when temperature is higher

1

[9]

5 (a) limiting their movement
or
controlling the temperature of their surroundings

1

reason:
reduces energy transfer

*if no other marks awarded, allow **1** mark for: 'fit more chickens in same space'*

1

(b) (i) without oxygen

ignore 'without air'

1

(ii) any **two** from:
- ethanol

  allow alcohol
- carbon dioxide
- lactic acid.

***do not accept** energy / ATP (apply list rule)*

2

(c) enzymes are denatured / change shape

ignore microbes are killed

1

(enzyme) shape is vital for function **or** won't work (as efficiently)

1

(d) (i) 200

1

(ii) 120

allow ecf from (d)(i)

e.g.

$\frac{60}{100} \times$ *(i)*

1

(e) causes global warming

1

one predicted consequence of global warming

eg rising sea levels, climate change, change in migration patterns, change in distribution of species

or

methane is flammable
so might cause fire / damage

*if no other marks awarded, allow methane is a greenhouse gas for **1** mark*

1

[11]

6 (a) (i) counts / 12

1

× 120 × 80 / × 9600

or

× area of field

1

(ii) (more) quadrats / repeats

1

placed randomly

ignore method of achieving randomness

1

(b) (i) any **three** from:

- temperature / warmth / heat
- water / rain
- minerals / ions / salts (in soil)

allow nutrients / fertiliser / soil fertility

ignore food

- pH (of soil)
- trampling
- herbivores

ignore predators

- competition (with other species)
- pollution qualified e.g. SO_2 / herbicide
- wind (related to seed dispersal).

ignore space / oxygen / CO_2 / soil unqualified

3

(ii) light needed for photosynthesis

1

for making food / sugar / etc.

1

effect on buttercup distribution eg more plants in sunny areas / fewer plants in shady areas

1

(c) (i) fertiliser / ions / salts cause growth of algae / plants

1

(algae / plants) block light

1

(low light) causes algae / plants to die

1

microorganisms / bacteria feed on / break down / cause decay of organic matter / of dead plants

*do **not** allow germs / viruses*

1

(aerobic) respiration (by microbes) uses O_2

*do **not** allow anaerobic*

1

(ii) sewage / toxic chemicals / correct named example eg metals / bleach / disinfectant / detergent etc

allow suitable named examples eg metals such as Pb / Zn / Cr / oil / SO_2 / acid rain / pesticides / litter

ignore chemicals unqualified

ignore waste unqualified

ignore human waste / domestic waste / industrial waste unqualified

1

(d) (i) 2

1

(ii) more food

allow other sensible suggestion eg more species colonise from tributary streams after forest

1

(iii) number of stonefly species decreases (from **A** to **B** / **B** to **C** / **A** to **C**) as more pollution enters river / less oxygen

allow fewer species in more polluted water

ignore none are found at site C

1

[19]

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

- amount of waste on each heap

  allow size of heap
- (type of) materials on each heap

  *if neither marking points one or two awarded, allow **1** mark for same waste*
- put heaps in same (environmental) conditions.

  e.g. keep at same (outside) temperature

  allow put in same place

2

(b) microorganisms / microbes / bacteria / fungi / decomposers

ignore detritivores / examples (such as worms, maggots, insects)

ignore pathogens / germs

*do **not** allow viruses*

1

(c) (i) oxygen / air added (when turning over)

allow idea that decay will be aerobic

allow bacteria / microorganisms need oxygen / air

allow (microorganisms) respire faster

1

(ii) any **two** from:

- dead leaves / fruit / plants (fall off / onto the ground)
- (fallen dead leaves / fruit / plants) decay
- minerals / ions / nutrients are recycled / released.

ignore references to carbon dioxide

*allow animal waste **or** dead animals*

2

[6]

8 (a) photosynthesis

1

(b) (i) 140

1

(ii) (10 billion tonnes) more added (to atmosphere) than removed

allow ecf from part (b)(i)

1

[3]

9 (a) methane / CH_4

allow CH_4

*do **not** allow CH^4 **or** ch4 or CH4*

1

(b) any **two** from:
- didn't carry out repeats
- only tested four types of manure
- don't know the mass of manure was the same each time
- inaccuracies in measuring (diameter of) balloon
- bottles might have been different sizes
- temperature of the room may have been different.

2

(c) The potato contains a lot of carbohydrate

1

[4]

10 (a) (i) correct bar heights

*three correct **2** marks*
*two correct **1** mark*
*one or none correct **0** marks*
ignore width

2

(ii) (Stream Y)

has many sludge worms / bloodworms

or

has no mayflies / caddis or few shrimp

*allow **1** mark if invertebrate not named but correct association given*

1

which indicate medium or high pollution

1

(b) (i) suspended solids increase (as a result of sewage overflow)

1

then decrease downstream / return to original levels

1

oxygen levels decrease (after sewage overflow)

1

and then rise again

1

(ii) any **three** from:

- mayflies decrease (to zero) near overflow
  accept 'have died out'
- because oxygen is low **or** mayflies have high oxygen demand
- mayflies repopulate / increase as oxygen increases again
- can't be sure if dissolved oxygen or suspended solids is the cause

3

(c) they respire / respiration

*aerobic respiration gains **2** marks*

1

this requires / uses up the oxygen

1

[13]

11 (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]

12 (a) (i) 10

1

(ii) any **three** from:

- both increase with distance
- more spp on walls than on trees
- no lichen spp on trees for first 1 km from city
- more steady / less erratic increase on trees than walls (or converse)
- rate of increase increases with distance

3

(b) SO_2 decreases with distance from centre

accept converse

Ignore pollution

1

high SO_2 reduces survival or kills lichen

accept converse

1

(c) (i) any **three** from:

- (line) transect
- quadrat / reference to specific area
- count number of lichens or coverage on trees
- at regular intervals / set distances

3

(ii) (more) Xanthoria nearest road

allow 'nitrogen-loving' for Xanthoria

1

(more) Usnea further from the road

allow 'nitrogen-sensitive' for Usnea

1

because most nitrogen oxide from vehicles (near road)

or

because nitrogen oxide levels will be falling / less further away (from road)

accept converse

1

[12]

13 (a) any **one** from:

- get lots of data
  accept more reliable / reproducible
  do not accept more accurate
- cheap / free
- unlikely to be biased
- can cover a wide area at the same time / takes less time
- see seasonal variations

1

(b) (i) correct bar heights
1 mark for each correct bar
ignore width of bars

2

(ii) 12 800
(16000 / 100)x80 on its own for 1 mark

2

(iii) goldfinch

1

(c) any **one** from:

- more food available
  accept fewer predators
- people feed them
  accept less habitat / food in countryside
- more rubbish / waste to eat

1

[7]

14 (a) microorganisms
allow microbes / bacteria / fungi / decomposers

1

(microorganisms) respire
*do **not** allow dead plants respire*

1

(respiration / decay / microorganisms) releases (thermal) energy / 'heat'
ignore produce 'heat'
*do **not** allow produce energy*
*do **not** allow dead plants release 'heat'*

1

(b) (i) any **three** from:

- (opening) allows oxygen in
- microorganisms / eggs need oxygen

  allow air for oxygen
- oxygen needed for respiration
- (opening) allows release of carbon dioxide (from microorganisms / respiration / eggs)

  allow gaseous exchange (1 mark) of / for microorganisms / eggs (1 mark) if none of first four points given
- (opening) allows energy / 'heat' to escape
- (closing) retains energy / 'heat' if too cool / at night

  *if no mark awarded for either of these points allow 1 mark for vents open in the day to prevent overheating **and** close at night to prevent it getting too cold*
- (closing) retains moisture

  allow (opening) releases moisture

3

(ii) any **one** from:

- maintains sex balance

  e.g. equal / best / correct numbers of male and female
- (survival of species depends on there being) males and females in population

  allow so the offspring are not all the same sex

1

[7]

15 (a) any **three** from:

- place 30-m tape measure across field / from one wood to the other
- place quadrat(s) next to the tape
- count / record the number / amount of dandelions / plants in the quadrat

  ignore 'record the results'

  ignore measures / estimates dandelions
- repeat every 2 metres

  allow every metre / at regular intervals

3

(b) (i) low light / it is shady

allow no light

ignore sun / rays

or

not enough water / ions / nutrients

accept correct named ion

ignore no water / ions / nutrients

or

wrong pH of soil

accept competition with trees for light / water / ions

ignore competition for space and competition unqualified

accept soil too acidic / too alkaline

ignore temperature

1

(ii) sensible suggestion for a small area, eg chance variation / anomaly / poisoned by animal waste / wrong pH of soil / eaten (by animals) / cut down / footpath

1

(c) repeat (transect) / compare with the results of other groups

allow 'do it in two different locations' for 2 marks

1

at different / random location(s) / elsewhere (across the field)

*do **not** allow 'in other fields'*

1

[7]

16 (a) (i) to get data re position of seaweed / of organism

1

in relation to distance from sea / distance down shore / how long each seaweed was exposed

1

(ii) repeat several times

minimum = 2 repeats

1

elsewhere along the shore

1

(iii) bladder wrack is further up the shore (than the sea lettuce) / exposed for longer

ignore found in dry areas / on bare rock

1

sea lettuce (only) in rock pools / in the sea / (only) in water

1

(b) gets more light / closer to light

allow better access to CO_2

1

(so) more photosynthesis

allow 1 mark for light for photosynthesis

allow 1 mark for CO_2 for photosynthesis

ignore reference to oxygen for respiration

'more' only needed once for 2 marks

1

[8]

17 (a) (i) (initially there is) oxygen

accept:
oxygen hasn't been used up yet (so not anaerobic conditions yet)

1

(so) <u>aerobic</u> respiration (by microorganisms)

accept (because) methane is produced in anaerobic (fermentation)

1

producing CO_2 (which does not burn)

accept there is no methane
ignore inflammable

1

(ii) (peelings had) the most carbohydrate / organic material

answer must be comparative

accept contained more microorganisms / decomposers / bacteria

ignore water

*do **not** allow fat or protein*

1

(b) (i) 0.22 / 0.221

correct answer with or without working gains 2 marks

allow 0.2 for 1 mark

allow 22.1 for 1 mark

allow 0.34 × 65 / 0.65 for 1 mark

2

(ii) (sheep manure) produces a higher volume of biogas / almost double **or** produces 0.27 (m^3 per kg) more

accept 0.408(7) / 0.41 / 0.409 (m^3) from sheep for 2 marks

accept 0.1877 / 0.188 / 0.19 (m^3) more than cow's manure for 2 marks

1

(sheep manure) produces biogas with a higher percentage methane **or** produces 2% more methane

allow correct difference in volume calculated using 0.408(7) / 0.41 / 0.409 minus answer given in (i) for 2 marks

1

[8]

18 (a) any correct named physical environmental condition, e.g. light / water / rain / temperature / minerals / nutrients / space (between plants)

ignore carbon dioxide / climate / weather / sun / pollution

1

genes / inheritance

ignore 'variety'

OR

any correct named biotic factor e.g. predation / disease

1

(b) mass of crop also depends on number of pods (per plant) / size / mass of each pea

ignore number of plants

1

(c) microorganisms / bacteria / fungi / decomposers / detritus feeders / named

1

decompose / rot / break down / decay / digest

ignore feed / eat

1

(these organisms) respire

*do **not** allow respiration by pea (plants)*

1

(decay / respiration / microorganisms etc) releases carbon dioxide

*do **not** allow combustion / fossilisation*

1

[7]

19 (a) extremophile(s)

1

(b) (i) common (periwinkle) and flat (periwinkle)

*either order, **both** required*

1

(ii) (common and flat) both live in the same habitat / area / named area

allow habitats overlap the most

1

(iii) any **two** from:

- would have wrong food
- would otherwise be exposed to (specific) predators
- cannot tolerate extended exposure to air **or** reduced submersion in seawater

  allow cannot tolerate temperature / dehydration
- cannot tolerate high salt concentration (in rock pools)

  allow low salt concentration (in rock pools)
- cannot compete with small periwinkle

2

[5]

20 (a) (i) 5.2

*award **2** marks for correct answer, irrespective of working or lack of it*

*award **1** mark for 62.4 ÷ 12 only with incorrect or no answer*

2

(ii) the smaller the (mass of the) bird the more energy is needed (per gram of body mass)

allow converse

ignore figures

1

(iii) smaller bird has larger surface area : volume / mass ratio

allow converse

1

so heat / energy lost more quickly

allow lose more heat / energy

*if (a)(ii) describes a trend of more energy with increasing body mass allow **one** mark for idea of more energy needed for flight*

1

(b) larger birds spend less time feeding

accept converse

allow the less energy they need per day the longer they spend feeding

1

since they need less food per gram of body mass (to satisfy energy needs)

1

[7]

21 (a) place all the quadrats randomly on the lawn

1

(b) (i) 1 4

2 2

3 2

4 0

all 4 counts correct

1

Total = 15

total correct for their figures

1

(ii) 1.5

allow ecf from (b)(i)

1

(iii) 180

correct answer with or without working

*if answer incorrect, allow **1** mark for* $\frac{15}{10}$ *x 120* ***or*** *15 x 20*

or $\frac{15}{10}$ *x 12 x 10*

or *1.5 x 12 x 10* ***or*** *1.5 x 120*

allow ecf from (b)(ii)

*allow **1** mark if only 1 error*

2

(c) use a larger sample size / more quadrats

ignore repeats but allow repeat in different places

ignore 'count them all'

or

use bigger quadrats

1

[7]

22 (a) use of quadrat / point frame

allow description

1

randomly placed / random sampling

ignore reference to transects

1

(b) (i) 6

1

(ii) more light in A / in field / where sunny
ignore sun
1

more / better / faster photosynthesis in A / with more light
allow converse
1

(iii) use light meter / measure light intensity in both habitats
1

take many measurements at same time of the day
1

or

laboratory / field investigation with 2 batches high light and low light (1)

count or number of flowers in each (1)
counting point is dependent on investigation point

(c) more glucose / energy available
allow other named product eg protein
allow if more energy produced
1

for growth
dependent on 1st mark
1

[9]

23 (a) microorganisms / microbes / bacteria / fungi / decomposers
*allow named example **or** mould*
ignore germs / worms / other detritivores
1

(b) (weather / it is) warm(er) / hot(ter)
accept optimum conditions for enzymes
allow cold(er) in winter
ignore wet(ter) / light(er) / sun
*do **not** accept heat dries the leaves out*
1

(c) oxygen
no mark if more than one box is ticked
1

[3]

24 (a) (i) increase / higher / faster / quicker
1

numerical comparison eg from 30 to 60 **or** by 30 **or** it is 30 at 15°C *and* 60 at 25°C

*award **2** marks for doubles / goes twice as fast or 30 units more*

1

(ii) any **two** from:

- oxygen / air (in)
  ignore air out
  *do **not** accept lets oxygen*
  ignore reference to other substances / light passing in or out
- for microorganisms / bacteria / microbes / fungi / decomposers
  ignore microorganisms passing in
  ignore worms / germs / bugs / other detritivores
- (for aerobic) respiration (of microorganisms)
- let excess heat out
  ignore heat in

2

(b) compost contains minerals / nutrients / elements / ions / named

allow improve drainage / moisture
allow contains nitrogen
ignore CO_2 / food / goodness / fertiliser
*do **not** accept vitamins / glucose*

1

[5]

25 (a) a higher concentration would be difficult to stir

1

(b) (i) methane

1

(ii) 60

100 - (5 + 35) but incorrect answer allow 1 mark

2

(c) (i) aerobic respiration

1

(ii) oxygen

1

[6]

26 (a) 40 – 60 hours

1

(b) (i) decrease

1

1st slowly then faster / appropriate detail from the graph – e.g. from 7.8 to 0 / faster after 4 – 10h

1

(ii) oxygen after glucose

extra box ticked cancels 1 mark

1

oxygen less than glucose

1

(iii) respiration

1

[6]

27

(a) (i) without <u>oxygen</u>

ignore reference to 'air'

1

(ii) otherwise difficult to stir / to pump / to transfer

allow prevent 'clogging' owtte

1

(iii) need to stir / pump / heat

1

(b) (i) rises then falls

1

then levels / slight rise

1

quantitative descriptor
- e.g. to 80% / max. on day 4 / min. on day 16

accept other valid quantitative descriptor

allow accuracy ± ½ small square

1

(ii) 16 (15.5 to 16.4)

1

(c) any **two** from:

- oxygen present
- (CO_2 produced) by <u>aerobic</u> respiration

  or not much anaerobic respiration
- **not** much methane / CH_4 produced

2

[9]

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

- (microorganisms) produce enzyme / amylase / carbohydrase
- to break down / digest starch / carbohydrate (in potato)
- into sugars / glucose
- which diffuse back into microorganism

accept decomposer / fungus / bacterium / cell

2

(b) (i) (microorganisms)

(accept bacteria / fungi / decomposers)

digest the potato (starch)

allow breakdown / feed on / consume / decompose

*do **not** accept eat*

1

use starch / glucose / carbohydrate for respiration

1

which releases carbon dioxide / CO_2 (into the atmosphere)

1

(ii) up to 40 °C the potato took less time to decay / the rate is faster

ignore yes / no

answers must be comparative

1

but at 50 °C it took longer / the rate is slower

or

at 50 °C / a high(er) temperature the enzymes have denatured

accept at a higher temperature / above 40 °C

1

[7]

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

- fewer trees to take in carbon dioxide for photosynthesis
- decomposers / microorganisms respire (as they decay debris) releasing carbon dioxide
- burning of wood releases carbon dioxide

allow carbon dioxide released by burning fossil fuels in vehicles / factories

2

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best − fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 − 2 marks)
There is a brief description of some steps in the process but the order is not clear with little biological vocabulary used.

Level 2 (3 − 4 marks)
There is a reasonably clear description of the process involving many of the steps and using some biological vocabulary.

Level 3 (5 − 6 marks)
There is a clear, logical and detailed scientific description of the process using appropriate biological vocabulary.

examples of biology points made in the response:

- this contains mineral ions (and organic matter)
- this increases growth of algae / water plants
- the plants / algae (underneath) die
- due to lack of light / photosynthesis / space
- decomposers / microorganisms feed on decaying matter **or** multiply rapidly
- the respiration of decomposers uses up all the oxygen
- so invertebrates die due to lack of oxygen
- this is called eutrophication

6

[8]

30 (a) estimate / count number of squares covered

*do **not** allow number of squares containing algae*

1

divide by total number of squares and multiply by 100 / multiply by 4

1

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

- more / most in North east facing
- followed by the North facing
- the South facing had no green alga / least

2

(ii) 40 (%)

1

two directions had this value (rest of directions had only one)

accept this is the most common percentage / value

2nd mark only if 40(%)

1

(iii) any **three** from:

- light / sunlight

  ignore Sun / carbon dioxide
- temperature

  *do **not** accept oxygen*
- availability of water / humidity
- availability of nutrients
- wind
- pollution qualified eg SO_2, acid rain, soot
- grazing by animals eg slugs
- competition with other species
- pH

3

(iv) eg (*for light*)

allow overlap between factors

light intensity *least* on north / north east facing parts of tree (1)

1

green algae adapted for photosynthesis in low light intensities (1)

allow, since less light from Sun, cooler so less evaporation

1

negative effect of high light intensity on green algal chlorophyll / photosynthetic pigments (1)

allow green algae unable to withstand desiccation

1

or (*for temperature*)

temperature highest on south (and west) facing parts of tree

(causing) more water to evaporate from this side of tree

green algae unable to withstand desiccation

or (*for moisture / rainfall*)

rainfall highest on north / north east facing parts of tree (1)

(giving) more moisture on this part of tree (1)

green algae less likely to desiccate (1)

or (*for wind*)

wind speed / duration greatest on south (and west) facing parts of tree (1)

(causing) more water to evaporate from this side of tree (1)

allow wind carries pollutants
allow pollutants toxic to algae

green algae unable to withstand desiccation (1)

or (*from pollution*)

from south / south west (1)

wind carries pollutants (1)

pollutants toxic to / kill algae (1)

(c) (i) as the concentration of ammonia increases so does the % abundance of nitrophyte lichens

allow positive correlation / proportional
allow directly proportional

1

scattered results / wide spread

allow use of approximate numbers to demonstrate scattering

or

for any value of one parameter there is a wide range of the other

allow not a strong relationship / correlation

1

(ii) not very useful / unreliable

accept only gives a rough idea / only a general indication

1

for any value of one parameter there is a wide range of the other

allow correlation rather than direct relationship

or

scattered results

1

[16]

31 (a) 8.05 / 8.1 / 8

*correct answer with or without working gains **2** marks*

*allow **1** mark for 8.0 **or** 8.10*

*allow 35/100 x 23 (million) for **1** mark if no answer or incorrect answer*

*allow **1** mark for 805 **or** 8 050 000*

2

(b) (i) any **one** from:

- less landfill sites used
- less cost (of landfill sites) / saves money
- less effort / cost to collect

allow less to collect

1

(ii) compost can be used on garden

*allow idea of compost can be used to help plant growth **or** compost provides minerals / named **or** compost improves the soil*

1

[4]

32 Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance.

0 marks
No relevant content.

Level 1 (1-2 marks)
For at least one process **either** the organism that carries it out **or** the carbon compound used **or** the carbon compound produced is described **or** for at least one organism **either** the carbon compound it uses **or** the carbon compound it produces is described **or** at least one process is named

Level 2 (3-4 marks)
For some processes (at least one of which is named) **either** the organisms involved **or** the carbon compounds used **or** the carbon compounds produced are described

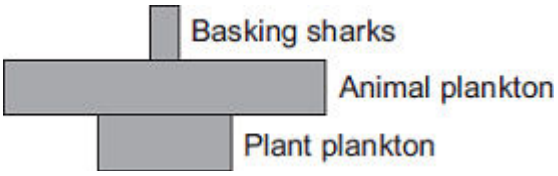
Level 3 (5-6 marks)
For at least one named process an organism **and** either the carbon compound used for the process **or** the carbon compound produced by the process are described **and** for other processes (at least one of which is named) **either** the organism **or** the carbon compounds used **or** the carbon compounds produced are described (as in Level 2)

Examples of Biology points made in the response:

- (green) plants photosynthesise
- photosynthesis takes in carbon dioxide
- (green) plants use carbon to make carbohydrate / protein / fat / organic compounds / named (e.g. enzymes / cellulose)
- animals eat (green) plants (and other animals)
- (green) plants respire
- animals respire
- respiration releases carbon dioxide
- (green) plants and animals die
- microorganisms decay / decompose / rot / break down / feed on dead organisms
- microorganisms respire

[6]

33 (a)



if more than one box is ticked award no mark

1

(b) increasing / higher light / temperature

ignore references to months other than February – April

*do **not** accept mineral / ions increase*

1

more / increased photosynthesis

*for both marks there must be a reference to 'more' at least once (e.g. 'more light for photosynthesis' gains **2** marks)*

*allow **1** mark for reference to light **and** photosynthesis without an idea of 'more'*

1

(c) increase due to increase in plant plankton / food

ignore references to months other than April – July

1

decrease due to fall in plant plankton / food **or** decrease as eaten by (basking) sharks

allow decrease as eaten by predators / animals / fish

1

(d) fall due to use / intake by plant (plankton)

ignore ref to no change section of graph

for fall allow March / April

ignore May / February

1

increase due to decay / decomposition / breakdown

for increase allow any month in range August to November

ignore December

1

of dead (plant / animal) plankton

allow of dead organisms / waste

1

[8]

34 (a) chose places randomly

1

method of obtaining randomness, e.g. (grid and) random numbers

allow thrown qualified e.g. over shoulder, eyes shut

allow max 1 for mention of a transect with sampling at regular or random intervals

1

(b) (i) 7 **or** 8

allow fractions / decimals between 7 and 8

1

(ii) count number of whole squares and add estimate of area covered by part squares

allow reference to counting squares with ½ cover or more

allow clear working on diagram and / or (b)(i)

1

(iii) 28 – 32 (in range)

allow ecf

*if answer incorrect allow **1** mark for reasonable reference to divided by 25 or multiplied by 4*

2

(c) nutrients / minerals / ions / fertiliser / water

allow light / pH / trampling / soil texture / grazing / mowing / weed killer / where seeds originally fell

ignore pollution / soil / competition if unqualified

ignore temperature / wind

1

[7]

35 (a) (i) (compost produced) quicker / faster / takes less time

it = tumbler bin

*answers should be comparative eg **only** 6 weeks = 1 mark*

6 weeks = 0 marks

1

(ii) any **two** from:

- takes less space
- cheaper (to buy)
- don't need to turn / rotate it

it = fixed bin

references to space and cost should be comparative

*do **not** accept unqualified data*

2

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

- faster rise (in tumbler)
- higher (in tumbler) **or** 2 correct number readings
- levels off (in tumbler) **or** continues to rise in fixed

it = tumbler bin

ignore eg faster compost

2

(ii) microorganisms / microbes / decomposers

allow bacteria / fungi / detritus feeders / worms / other named examples of detritus feeders / mould

1

aerobic

allow air(y)

allow oxygen(ated)

1

(iii) faster respiration / decay / **or** microorganisms / microbes / decomposers work faster (in tumbler)

allow converse
allow bacteria / fungi / mould

1

so more heat produced (in tumbler)

ignore heat produced by friction

OR

more air / more oxygen(ation) (in tumbler) (1)

so more respiration / faster decay / bacteria work faster (in tumbler) (1)

1

[9]

36 (a) (i) triangular pyramid with 3 layers

may be as blocks or as triangle
ignore food chains and arrows

1

layers appropriately labelled:
bean / plant

aphid,

ladybird

*labelled in food chain order must **not** contradict correct pyramid*
*allow correctly labelled inverted pyramid for **2** marks*

1

(ii) any **two** from:
(for aphid / ladybird)

ignore energy

- not all digested / faeces
- loss in urine
- loss of CO_2

  ignore loss of CO_2 from bean plant
- not all eaten

  *if none of first 3 points given then allow waste (materials) / excretion for **1** mark*

2

(b) microorganisms / microbes / bacteria / fungi / decomposers / detritivores /named

*do **not** accept germs*

allow mould

ignore aphids

1

decay / breakdown / digest / decompose / rot (bean plant)

ignore eat

1

respiration (of microorganisms etc / aphids)

allow burning / combustion

1

carbon dioxide released (from respiration of microorganisms etc / aphids)

allow carbon dioxide released / produced (from burning / combustion)

ignore other parts of the carbon cycle
ignore formation of fossil fuels

1

[8]

37 any **three** from:

ignore references to carbon cycle

accept digested / decomposed / broken down / rotted for decay throughout

ignore eating

- dead leaves / flowers / bluebells are decayed
- idea that microorganisms do the decaying

  accept microbes / bacteria / fungi / mould / decomposers for microorganisms
- minerals / ions / nutrients / named released (by decay / microorganisms)

  ***not** mineral ions unqualified*
- (released) into soil **or** minerals / ions / nutrients taken up / in by (bluebell) roots (next year)

  look for idea that minerals / ions / nutrients are in soil (eg released into soil or taken up from soil)

3

[3]

38 (a) 0.18

award both marks for correct answer irrespective of working

if no answer or incorrect answer

*allow **1** mark for 45 × 100 / 25000*

2

(b) heat / thermal

allow heat <u>from</u> respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

ignore reference to losses via eg respiration / excretion / movement / heat

1

a sensible / appropriate use of figures including heron

*eg <u>only</u> **2** from frog / to heron*

ignore units

1

(d) any **three** from:

accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot

  ignore eat

- (breakdown) releases minerals / nutrients / ions / salts / named

  ignore food

- (microorganisms) respiration

  ignore other organisms respiring

- (microorganisms / respiration) release of carbon dioxide

3

[8]

39 (a) (i) <u>anaerobic</u> respiration

or

fermentation

1

(ii) <u>oxygen</u> is present

accept O_2

*do **not** accept O, O^2 or O^2*

1

aerobic respiration occurs

ignore anaerobic

1

CO_2 from respiration

allow from fermentation

1

(b) high methane after this time

ignore CO_2

1

(c) organic matter / food / nutrients / named eg used up / reactants

allow too hot / accumulation of toxins / named

*do **not** allow products*

ignore energy

1

[6]

40

(a) (i) sun

ignore light

apply list principle

1

(ii) photosynthesis

apply list principle

allow approximate spelling

*do **not** accept phototropism*

1

(b) (i) chemical

1

(ii) carbon dioxide

1

(iii) carbohydrates

1

(c) As carbon dioxide from the caterpillar

if more than 2 boxes ticked deduct one mark for each additional incorrect box

1

As faeces (droppings) from the blue-tit

1

[7]

41 (a) too cold / very cold **or** oxygen / microbes cannot reach it

allow not enough energy / heat / warmth
ignore frozen

1

for microorganisms / microbes / bacteria / fungi / enzyme / reaction (to work)

ignore other consumers

1

(b) no longer exist
or no more left
or died out / all died

ignore died unqualified

1

(c) (i) egg cell

1

(ii) nucleus

1

(iii) given an electric shock

1

(iv) womb

1

(d) has mammoth genes / chromosomes

accept genetic information / DNA / alleles / nucleus
accept converse

1

[8]

42 (a) **X** respiration

correct order only
allow decay / decomposition / rotting
ignore breakdown / disintegrate

1

Y combustion / burning

1

(b) any **three** from:

- photosynthesise / absorb carbon dioxide
  *accept are producers **or** produce / make biomass / glucose / other named*
  *do **not** accept photosynthesis releases CO_2*
- release carbon dioxide / respire
- eaten by animals
- fed on / decayed by microorganisms
  ignore eaten by microorganisms

3

(c) any **two** from:

(in tropical rainforest conditions are)

- warm(er) / hot
- damp / moist / wet / humid
  ignore rain
- a lot of microorganisms
- a lot of material to decay
  *allow warm(er) so enzymes work faster for **2** marks*

2

[7]

43 (a) (i) 0.6 **or** 6×10^{-1}

for correct answer

if no / incorrect answer $\frac{2.4 \times 10^4}{4 \times 10^6} \times 100$

or

*0.006 **or** 6×10^{-3} gains **1** mark*

2

(ii) any **two** from:

- reflected
  ignore some of light is green
- not absorbed **or** misses chloroplasts / chlorophyll
  *allow transmitted **or** passes through leaves*
  allow hits other plant parts
- wrong wavelength
- photosynthesis inefficient
  accept other limiting factors / named
- allow some lost through respiration / as heat (from respiration)

2

(b) energy lost via faeces / not digested / waste / excreted (of insect-eating birds)

1

energy loss via respiration / movement / muscle contraction / heat
(by insect-eating bird)
accept examples of muscle contraction
*do **not** accept energy used for respiration*

1

some of (insect eating) bird not eaten <u>but</u> all / most / more of insect is eaten

1

[7]

44 (a) (i) (white) clover

1

(ii) reed sweet-grass
allow reed
allow grass

1

(iii) (only) found in swamp and aquatic zones **or** <u>only</u> found in water
or doesn't grow in marsh
ignore wet conditions

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.
Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)
There is a basic description which describes how a quadrat **or** a metre tape could be used to collect data

Level 2 (3-4 marks)
There is a clear description of how a quadrat **and** a metre tape could be used to collect data along a line

Level 3 (5-6 marks)
There is a clear, logical and detailed description of a method that will produce valid, repeatable results across / at intervals along the stream.

examples of procedural points made in the response:

- use of tape measure to produce transect
- placing of quadrats
- transect placed across stream
- score presence of each plant species
- use quadrat at regular intervals along tape
- repeat transect several times (≥ 3)
- along stream
- at random **or** regular intervals

6

[9]

45 (a) (biogas / methane is made) by fermentation / anaerobic respiration

accept reverse argument

*accept for **1** mark so no oxygen in jar **or** so oxygen can't enter **or** makes conditions anaerobic*

ignore references to keeping other microbes out

ignore air

2

(b) (i) carbon dioxide

accept CO_2 / CO2

*do **not** accept CO^2*

1

(ii) 0.62 look for answer in table

*correct answer with or without working gains **2** marks*

*allow 62% for **2** marks but 62 for **1** mark if incorrect / no answer*

$\frac{426}{686}$ *gains **1** mark*

2

(iii) (more fat → much) more biogas / methane

allow more implied by giving two numbers or a subtraction / division

1

(more fat →) only <u>small</u> increase in proportion / concentration / percentage of methane

*allow increases only from 0.60 to 0.63 **or** <u>only</u> changes by 0.03*

or approximately constant

or no change above 5%

1

(iv) fat (too) expensive **or** fat (too) expensive to transport (from coast to farm)

accept any suitable reference to extra cost / effect on environment
eg more pollution from transport

1

[8]

46 (a) (i) 70

*award **2** marks for correct answer irrespective of working*

*allow **1** mark for 30 + 10 + 24 + 6 (with wrong answer or no answer), do **not** award this sum if other figure(s) are included in the addition*

2

(ii) 6

*award **2** marks for correct answer irrespective of working*

*award **2** marks for correct answer to (a)(i) – 64 (ecf)*

*award **1** mark either for 70 – 64 or answer to (a)(i) – 64 with no answer or incorrect answer*

2

(b) photosynthesis.

1

[5]

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

- food / feeding
  ignore water
- mates / mating
- territory / space / land / shelter / nesting sites
  ignore homes / place to live / habitat / resources
- status (within group)

2

(b) (i) rises to 1480 to 1500
or rises by 880 to 900
or rises until 1993
ignore incorrect figures if 1993 given

1

falls to 400 to 440 **or** falls by 1040 to 1100
*if neither mark gained then allow **1** mark for rise followed by fall **or** fell by 160 to 200*

1

(ii) <u>rises because</u>: -
less competition from mule deer
or mule deer population falling
or fewer mule deer
ignore reference to food / breeding
ignore reference to predation / disease

1

<u>falls because</u>: -
more competition from mule deer
or mule deer population rising
or more mule deer
ignore more / less suited to environment
*if neither mark gained then correct reference to competition gains **1** mark*

1

[6]

48

(a) 16

*accept correct answer for **2** marks, irrespective of working*

*if no answer **or** answer incorrect accept 0.64 x 100 / 4 (.0) **or** 0.16 for **1** mark*

2

(b) insect cold-blooded / not warm blooded **or** does not control body temperature

accept mammal warm-blooded / constant (high) body temperature / controls body temperature

1

reference to insect 0.96 (kJ) **and** mammal 12.25 (kJ) transferred by respiration **or** relevant calculation of this transfer

ignore references to other data

1

(less respiration) so more energy / biomass / food available (for growth of insect)

(more respiration) so less energy / biomass / food available (for growth of mammal)

1

[5]

49

(a) three layer triangular pyramid

either way up (as blocks or triangle)

1

(soya / beans / food – trout / fish – people / human (in sequence)

ignore reference to producers /herbivores / consumers

*award **1** mark only for a correct food chain with 2 correct arrows showing energy flow*

1

(b) the trout release energy when they respire

1

some energy will be lost in waste from the trout

1

(c) any **one** from eg

- easy / easier to catch / more caught
  allow easy / easier to monitor
- easy / easier to feed
  allow control food
- no / less predation
  allow less fishing / poaching
- less energy loss
  allow grow faster
- less movement
  ignore less space to move
  *do **not** allow easier to farm*

1

(d) any **two** from:

- microorganisms / bacteria /decomposers / microbes / fungi /detritus feeders
- decay / rot / decompose / digest /break down
  ignore biodegrade
- (microorganisms) respire
  *do **not** award this mark if response implies the trout respire*
- turned into fossil fuels / named fossil fuels
- carbon dioxide / CO_2 released

2

[7]

50 (a) very little of the biogas generator will be seen
*cancel **1** mark for each extra box ticked*

1

the temperature inside will not change much

1

(b) (i) methane

1

(ii) 60

correct answer with or without working

*100 – (35 + 1.5 + 1.5 + 2) but incorrect answer allow **1** mark*

2

[5]

51 (a) methane / CH_4

allow CH^4 / CH4 / H4C

1

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

ignore reference to smell

- less visual impact
- less heat loss

or
(better) insulated

or
temperature will be less variable /keeps warm / keeps cool **or** easier to maintain optimum temperature

- withstand pressure build-up
- ease of adding material / slurry

2

(ii) any **one** from:

- to keep anaerobic
- to prevent oxygen / air entering
- to prevent biogas escaping
- to maintain pressure / to allow removal of biogas

1

(c) any **two** from:

ignore to keep warm

- to maintain optimum temperature

  if reference to specific temperature accept any value in range 26 – 40 °C as optimum

- to speed up production of biogas

  or

  reference to faster microbial action / named microbial process

- UK temperature is low/below 25 °C

  *UK temperature is below optimum = **2** marks*

- self sufficient / sustainable

2

[6]

52 (a) (i) quadrat / grid

allow suitable description in a(i) or a(ii)

allow quadrant

1

(ii) any **two** from:

- use a transect / description

  allow measure distance of the test or sample site from road

- sample every metre

  ignore random placing of quadrat

- count plants (in quadrat)

2

(iii) the nearer to the road, the more (plantain) plants

accept the more dead nettles the less plantains

1

(b) (i) any **two** factors from: eg

- grow better / survive away from road
- sensitive to pollutant / named pollutant / dust / fumes
  ignore carbon dioxide as pollutant
- (roadside) weedkillers
- trampling /damage / turbulence
- grass cutting
- competition
- aspect eg hillier

or

give **one** mark for a factor and **one** mark for its effect eg

dust (from road) (1)

reduces photosynthesis (1)

or

'loses' in competition (1)

for light / water / nutrients / minerals / ions / space / soil (1)
ignore food for plants

2

(ii) any **two** factors eg

ignore distribution

- can withstand pollution

  allow grows better in polluted air

  ignore 'prefer' pollution

- competition

- aspect eg flat

or

give **one** mark for a factor and

one mark for its effect eg

use carbon dioxide (from traffic) (1)

enhances photosynthesis (1)

or

'wins' in competition (1)

ignore food for plants

for light / water / nutrients / minerals / ions / space (1)

2

[8]

53 (a) microorganisms

1

(b) moist

1

(c) respiration

1

(d) roots

1

[4]

54 (a) B and D

both required in any order

1

(b) any **two** from:

*do **not** accept compounds restricted to animals*

- carbohydrate / named example

  *allow **2** marks for 2 named examples*

  *do **not** allow a general name and a named example for **2** marks (eg award **1** mark only for carbohydrate and starch)*

- protein / enzyme

  *allow **2** marks for 2 named examples*

- amino acid
- hormone / named plant hormone
- lipid / fat / oil / wax
- chlorophyll
- DNA
- vitamin(s)

2

(c) contains minerals / salts / ions / nutrients / named

ignore 'food'
*do **not** allow vitamins / glucose / energy etc*

1

(needed by plants) for health / better growth

for / help plant growth is insufficient

ignore moisture retention / soil structure

ignore more plants

*allow examples linked to mineral eg contains magnesium to make chlorophyll for **2** marks*

1

[5]

55 (a) A higher concentration would be difficult to stir

1

(b) (i) methane

1

(ii) 60

*100 - (5 + 35) but incorrect answer allow **1** mark*

2

(c) (i) aerobic respiration

1

(ii) oxygen

1

[6]

56 (a) (i) without <u>oxygen</u>

ignore reference to air

1

(ii) otherwise difficult to stir / to pump / to transfer

allow prevent 'clogging' owtte

1

(iii) need to stir / pump / heat

1

(b) (i) rises then falls

1

then levels / slight rise

1

quantitative descriptor eg to 80% / max. on day 4 / min. on day 16

accept other valid quantitative descriptor

allow accuracy ± $\frac{1}{2}$ small square

1

(ii) 16 (15.5 to 16.4)

1

(c) oxygen present

1

(CO_2 produced) by <u>aerobic</u> respiration

or not much <u>anaerobic</u> respiration

or not much methane / CH_4 produced

1

[9]

57 (a) the sun / light / sunshine / solar

allow radiation <u>from the sun</u>

ignore photosynthesis / respiration

apply list principle

*do **not** allow water / minerals / heat*

1

(b) 2.5 (:1)

correct answer with or without working

ignore rounding with correct working

*do **not** allow other equivalent ratios for both marks*

*evidence of selection of 10(insects) **and** 4(frogs) **or** 50 **and** 20 **or** 1 **and** 0.4 for **1** mark*

if no other working allow **1** mark for 0.4:(1) on answer line

2

(c) any **two** from:

*allow for insects **or** frogs*

allow energy for biomass

- some parts indigestible / faeces
- waste / examples of waste eg urea / nitrogenous compounds / urine / excretion
- movement / eg of movement

  allow keeping warm
- heat
- not all eaten / eg of not all eaten
- respiration

  do not accept energy for respiration

2

(d) any **four** from:

- (bodies) consumed by animals / named / scavengers / detritus feeders
- microorganisms / bacteria / fungi / decomposers
- reference to enzymes
- decay / breakdown / decompose / rot
  ignore digest(ion)
- respiration
- carbon dioxide produced
- photosynthesis
- sugar / glucose produced
  accept other organic molecules
- fossilisation / fossil fuels / named
- combustion / burning
  must be linked with fossilisation / fossil fuels
- (burning) produces carbon dioxide
  allow carbon dioxide produced once only

4

[9]

58 (a) carbon dioxide **and** water vapour
either order

1

(b) less methane

1

because less anaerobic respiration

1

more CO_2
ignore water

1

because (more) aerobic respiration

1

[5]

59 (a) (i) increase / higher / faster / quicker

1

numerical comparison eg from 30 to 60 / by 30 **or** it is 30 at 15°C and 60 at 25°C

*award **2** marks for doubles / goes twice as fast or 30 units more*

1

(ii) any **two** from:

- oxygen / air (in)

  *do **not** accept lets oxygen / air out*
  ignore reference to other substances / light passing in or out ignore microorganisms passing in

- for microorganisms / bacteria / microbes / fungi / decomposers

  ignore worms / germs / bugs

- (for aerobic) respiration

- let heat out

  ignore heat in

- heat kills microorganisms

2

(b) compost contains minerals / nutrients / elements / ions / named

allow improve moisture / drainage
allow nitrogen
ignore CO_2 / food / goodness / fertilisers
*do **not** accept vitamins / glucose etc*

1

[5]