Q1.

(a) diffusion

1

(b) A

1

(c) B

1

(d) (earthworm) can absorb more oxygen (in a given time)
or
increases / more gas exchange

allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food

1

(e) lipase

1

(f) more oxygen (in soil with earthworms)

allow earthworms bring oxygen to soil

1

(for) more (aerobic) respiration

*do **not** accept anaerobic respiration*

1

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

1

reference to more is only needed once for the first two marking points

(g) fertilisation

ignore sexual reproduction

1

(h) asexual (reproduction)

allow cloning

1

[10]

Q2.

(a) description of a method to achieve random placement

examples could include random number generator or random coordinates
*allow throw over the shoulder **or** with eyes shut*
ignore throw unqualified

1

(b) any **one** from:

- random (location)

allow by chance

- avoid bias
- obtain valid / representative results

allow more accurate / precise mean

ignore fair test / accurate / precise unqualified

1

(c) as a control / comparison

allow see the difference

1

or

B varies from A in only one factor

*do **not** accept a control variable*

(to) show results (in A) are due to weed killer

allow to see the effect of the weed killer
allow so the results are valid

1

(d) 11

allow eleven

1

(e) $\frac{10-2}{10} \times 100$

1

80

1

*an answer of 80 scores **2** marks*

(f) use more quadrats

allow use larger quadrats
allow repeat

1

original may not be representative **or** reference to weeds being distributed unevenly

allow mean is more reliable / accurate / precise
ignore more valid

1

or

leave for more than two weeks (1)

original may not be representative (1)

allow mean is more reliable / accurate / precise
allow weed killer may take longer than two weeks to work (fully)
ignore more valid

[9]

Q3.

(a)

	1960 − 1977	1977 − 2003	2003 − 2015	
trend in carbon dioxide concentration		increasing	increasing	1
trend in air temperature	decreasing	increasing	constant / decreasing	1

allow synonyms e.g. level / goes up / goes down

(b) traps heat / energy or (long-wavelength / IR) radiation

*do **not** accept light / UV*

or

less loss of heat

allow stops (some) heat escaping
*do **not** accept stops all heat escaping*

or

insulates

ignore greenhouse effect
ignore reference to ozone layer

1

(c) **Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. They are not logically linked.

1–2

No relevant content

0

Indicative content

for the theory:

- (overall increased CO_2 parallels) overall increased temperature (e.g. by 0.4 (°C))
- CO_2 traps (long-wave) radiation / IR / heat

against the theory:

- in some years (e.g. 1960–1977) temperature falls (while CO_2 is rising)
- many (large and small) erratic rises and falls in temperature
- overall correlation does not necessarily mean a causal link
- other (unknown) factors may be involved in temperature change

to access level 2 there must be evidence both for and against the theory **and** use of data from the graph

(d) burning of (fossil) fuels

allow e.g. coal / oil / gas

allow

driving cars
allow any activity which leads to burning fuels − e.g. using central heating

ignore power stations unqualified
ignore burning / fires unqualified
ignore deforestation

1

(e) photosynthesis

allow full description or full equation
allow a symbol equation which is not balanced

1

(f) any **two** from:

- (some) plants grow faster / higher yield
- loss of habitat
- migration **or** change in distribution*
- extinction*

if neither is given allow alters biodiversity for **1 mark*

allow (in terms of extinction) death due to e.g. lack of water / food or increased disease

ignore death unqualified

2

allow points made using examples

[11]

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) *x*-axis: scale + labelled, including units

scale ≥ ½ width of graph paper label: biomass in g/m²

1

bar widths correct

± ½-square each side
allow 1 mark if 3 correct

2

all 4 bars correctly labelled

large fish + small fish + invertebrate (animals) + algae
or
(trophic level) 4 + 3 + 2 + 1
or
tertiary consumer + secondary consumer + primary consumer + producer
ignore bar heights

1

(b) $\frac{840-10}{840} \times 100$

allow equivalent calculation

1

98.809523... / 98.810 / 98.81 / 98.8

1

99

allow answer given to two significant figures from an incorrect calculation in step 2

1

*an answer of 99 scores **3** marks*

(c) inedible parts / example

*allow eaten by other animals **or** not all organisms eaten*

or

egested / faeces

allow not digested
allow excretion / urine
ignore waste

or

respiration / as CO_2

ignore energy losses
ignore movement

1

(d) bacteria decay organic matter / sewage / algae / dead plants

1

(by) digestion

allow example such as starch broken down to sugar
or
protein broken down to amino acids

1

(and) bacteria respire aerobically
or
respire using oxygen

1

(which) lowers oxygen concentration (in water)
or
fish have less oxygen

allow reduced respiration of fish

1

(so) reduced energy supply causes death of fish

allow toxins in the sewage kill fish
ignore pathogens or (pathogenic) bacteria cause disease in fish and kills them

1

[13]

Q6.

(a) 3.7

1

(b) 2

1

(c) (different combinations of alleles cause) many / 22 values

allow continuous variation

or
in-between values
or
large range of values
or
there are not only two values

*allow there are not only 3 values if 3 is given in part **(b)***

1

(d) different protein made

allow change in shape (of enzyme) or change in 3-D structure
ignore denature

1

active site changed

1

so substrate does not fit / bind

allow description of substrate
allow cannot form E-S complex
ignore lock and key description

1

(e) produces (some) offspring with high-fat milk
or
not all offspring have low-fat milk

ignore reference to alleles

1

(f) takes less time (to obtain results)
or
more offspring at the same time

*allow other sensible suggestion − e.g. allows screening **or** allow cow 7 to continue to produce eggs **o**r avoid injury to cow 7 during mating or giving birth*

1

(g) male gametes correct: d (and d)

1

female gametes correct: D and d

1

*allow **1** mark if gametes are correct but gender not identified*

correct derivation of offspring genotypes from given gametes

*allow 2 × 2 **or** 2 × 1 derivation*

1

Dd identified as low-fat **and** dd identified as high-fat in offspring

if DD offspring are produced, must also identify as low-fat

1

(h) find female with low(est) fat in milk **and** high(est) milk yield

allow choose from 7, 9, 12, 13 which has the highest yield

1

find male whose female offspring have high(est) milk yield **and** low(est) fat in milk

allow choose from 16 or 18 whose female offspring has the highest yield

1

or

find female with lowest fat in milk
or cow 13 (1)*

**or*
allow female with high(est) milk yield

find male whose female offspring have high(est) milk yield (1)*

**or*
allow male whose female offspring have lowest fat in milk / male 16

cross the best (for both features) female with the best male

1

select best offspring (for both features) from each generation and repeat for several generations

1

[16]

Q7.

(a) to kill microorganisms on / in the flask
or
so only microorganisms in the milk caused the results

allow bacteria / fungi / microbes
*do **not** accept viruses*
ignore germs

1

(b) heating

1

to over 100 °C

allow place in oven / pressure cooker
*do **not** accept disinfectant*
allow other suitable method – e.g. use of UV

1

(c) to prevent microorganisms entering from the air

allow bacteria / fungi / microbes for microorganisms
*do **not** accept viruses*
ignore germs

1

(d)

0	olive-green	**7**

1	olive-green	**7**
2	olive-green	**7**
3	orange-green	**6**

*all correct for **1** mark*

1

(e) (pH meter) – more accurate / more precise
allow more exact
allow can measure to 0.1 pH unit
***or** to smaller intervals of pH*

1

(leaving…6 days) – obtain greater pH change
or
because there was (very) little change in 3 days
allow more acid will be made

1

(f) scale > $\frac{1}{2}$ of x-axis
and
x-axis labelled (time in) days

1

points plotted correctly
*all 7 correct = **2** marks*
*5 or 6 correct = **1** mark*

2

line of best fit = smooth curve through points
*do **not** accept ruled point-to-point*

1

(g) (1st day) too few bacteria

1

(after day 1 more bacteria so more) acid made

1

(days 5-6) sugar / food used up
or
low pH denatures enzymes
or
low pH kills bacteria
allow enzymes do not work
*do **not** accept enzymes killed*

1

(h) (similarity) – same start pH /
pH7 and end pH / pH4.5
or
same pH change / change = 2.5

1

(difference) – faster

1

[16]

Q8.

(a) any **two** from:
- sprinkled through air
- air spaces between stones
- thin layer over stones (for efficient diffusion)
- slow flow (for efficient diffusion)

2

(b) green algae

1

(c) (large / small) protist

1

(d) **Level 2 (3-4 marks):**
Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

Level 1 (1-2 marks):
Facts, events or processes are identified and simply stated but their relevance is not clear.

No relevant content (0 marks)

Indicative content

digestion:
- (external) enzymes released
- role of enzymes – e.g. amylase / protease / lipase
- substrates & products – e.g. starch ⟶ sugar / protein ⟶ amino acids / fat ⟶ fatty acids

absorption:
- by diffusion / active transport

deamination:
- amino acids ⟶ ammonia / ammonium ions

release of other ions:
- e.g. phosphate / nitrate / magnesium

respiration:
- produces carbon dioxide (+ water)
  or
  equation is given
- release of energy allows other processes to take place e.g. active transport

[8]

Q9.

(a) large number – more representative and so more valid (mean can be calculated)
allow more reliable

1

random – avoid bias

1

(b) correct figures in table:
(3)
(8)
(16)
19
9
4
1

1

(c) all bars plotted correctly

± 1 mm

allow ecf from the table

1

(d) any **three** from:

- much overlap of values between the 2 shores

sheltered shore:

accept converse for exposed shore

- wider range **or** use of figures – e.g. approx 0.26 to 0.70 cf 0.21 to 0.55
- higher mode **or** use of figures – e.g. 0.41 to 0.45 cf 0.36 to 0.40

allow ecf for figures from (b)

- there are no limpets at 0.21 to 0.25

allow there are no limpets on exposed shore at 0.56 to 0.70

3

(e) sheltered – 0.47 **or** 0.466

1

exposed – 0.35 **or** 0.354

1

(f) radius = 2.48 cm

*an answer of 38.6 / 38.62 / 38.64 scores **3** marks*

1

(area = 3.14 × $(2.48)^2$ =) 19.3 cm^2

allow area calculated from incorrect radius

1

(force = 19.3 × 2 =) 38.6 (newtons)
or
(force = [3.14 × $(2.48)^2$] × 2)
= 38.62 (newtons)
or
(force = [π × $(2.48)^2$] × 2)
= 38.64 (newtons)

allow force calculated from 1 previous error

1

(g) any **two** from:
- foot may not be circular
- foot may be larger / smaller than outside of shell
- scientists' value is approximate
- variation between limpets / described

*e.g. re muscle development **or** greater 'awareness' of some limpets*

- variation in rock surface texture

2

(h) any **three** from:
- more force of waves to dislodge limpets
- lower height lowers exposure to waves
- wider foot gives greater grip
- those with this / these feature(s) pass on alleles / genes to offspring leading to population of broad squat limpets

allow converse for sheltered shore throughout, if clearly stated

3

[17]

Q10.

(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]

Q11.

(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]

Q12.

(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]

Q13.

(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]

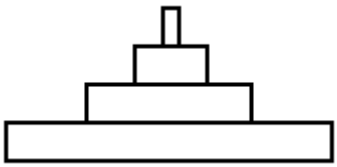
Q14.

(a) any **two** from:

- *idea of* absorption of light / energy
- transfer to chemical energy

  allow produce sugars / glucose / starch / carbohydrate / food / biomass
- provides food / energy for animals / caterpillar
- releases oxygen

2

(b) 

1

(c) 15(%)

allow ***1*** *mark for* $\frac{3 \times 100}{20}$ *with no answer or incorrect answer*

or

allow ***1*** *mark for 0.15*

2

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

- markings look like eyes / face / mouth of much larger animal
- looks fierce / scary / dangerous

  allow it looks like a snake
- to frighten blue tit / bird

max 1 if reference to camouflage

2

(ii) any **two** from:

- sharp / long / big claws

  ignore strong
- sharp / hooked beak

  ignore strong / big
- large wings **or** flies quickly

  allow streamlined / aerodynamic

  ignore powerful wings
- good eyesight

2

[9]

Q15.

(a) any **one** from:

- continuous readings
- do not need to be there

  allow automatic readings
- (more likely to be) accurate

allow greater resolution

*do **not** allow valid*

- reduces human error

allow easier to read

1

(b) (i) microorganisms

allow microbes / bacteria / fungi / decomposers for microorganisms, throughout

1

(microorganisms) respire

1

respiration / decay / microorganisms releases carbon dioxide

ignore carbon released

1

(ii) all grass decomposed / decayed / rotted

*allow idea that all microorganisms dead (due to accumulation of waste **or** lack of oxygen)*

allow lack of / no oxygen (for respiration of microorganisms)

1

[5]

Q16.

(a) 0.67(%)

allow $0.\dot{6}$ or 0.7

*allow **1** mark for evidence of* $(2 \times 10^6) \div (3 \times 10^8)$

or

*allow **1** mark for 0.0067 or 0.6*

2

(b) (i) idea that food chains start with plants / producers

*allow food chains do not start with animals **or** larvae are consumers*

1

idea that these make food (for other organisms in the chain)

*allow idea that plants / producers photosynthesise **or** plants / producers get energy from the sun*

*allow mosquito larvae do not make food / photosynthesise **or** mosquito larvae do not get energy from the sun*

1

(ii) any **four** from:

- reasoned argument for **or** against release

must refer to at least one advantage and one disadvantage.
*max **3** marks for either only advantages **or** only disadvantages*

advantages:

- fewer mosquitos biting **or** spreading malaria

- fewer people get / die from malaria
  allow people won't get / die from malaria
- lower medical costs (for those infected **or** for treatment) **or** less healthcare needed
- better economically for developing / tropical countries.

disadvantages:
- fewer crops reproduce
  allow fewer crops pollinated
- poorer crop yield
- possible starvation (of people)
- high cost of GM production / mosquito release
- less food for bats / birds **or** bats / birds die
  *allow disruption to food chain / ecosystem **or** reduction of biodiversity*
- gene could 'escape' into other wildlife / species
  ignore into plants

4

(iii) any **three** from:
- gene from bacteria cut out
  allow allele for gene
- ref to enzymes (anywhere in process)
  allow at any point in process, ie in cutting or in splicing
- (gene) transferred to chromosome of mosquito
  allow DNA for chromosome
- at an early stage of development
  allow egg / embryo

3

[11]

Q17.

(a) (i) any **two** from:
- not all eaten
  allow eaten by other animals
- used for respiration
  ignore used / lost in heat / movement
- lost as CO_2 / water / urea
- lost as faeces **or** not all digested
  if neither mark awarded allow 1 mark for lost as waste

ignore references to energy losses

do not allow for growth / repair / reproduction

2

(ii) any **one** from:
- thrushes eat other things
- thrush numbers likely to vary (considerably)
  *allow it is only an estimate (of population size) **or** only counted thrushes for 5 hours*
- thrushes were not present all the time
- thrushes feed on a much bigger area

1

(b) (i) any **one** from:
- there are two dependent variables
- there is no independent variable
- to show the association / correlation / pattern (between the two variables)

1

(ii) (snails in woodlands)
more have dark(er) colour(ed shells) **or** fewer have light-coloured shells
allow converse for grassland, if clear

1

(shells have) no / fewer stripes or have no stripes
allow converse for grassland, if clear

1

(iii) less likely to be seen (by predators / birds / thrushes)
allow camouflaged (from predators / birds / thrushes)
allow light coloured shells with stripes would be more visible (to predators / birds / thrushes in woodland (than grassland)).

1

[7]

Q18.

(a) 88 000
correct answer = 2 marks
allow 1 mark for 1.1 (in 1 m^2)
or
allow 1 mark for answer = [candidate's value in 1m^2] × 80 000

2

(b) Place the quadrat in 100 random positions.

1

(c) any **three** from:
must include at least one advantage and one disadvantage for full marks

Advantages:
- less cost / free
- less likely to kill other (harmless species of) plants
- weedkiller may be toxic **or** may cause water pollution
- weedkiller may accumulate up food chains
  allow uneven distribution of ragwort so much wastage of weedkiller

Disadvantages:
- volunteers may mistake other species for ragwort
- volunteers may miss plants
  allow weeds will grow back
- some ragwort left to poison horses

- time consuming
- difficulties getting enough volunteers

if no other disadvantages; allow ref. to issues with volunteers – eg don't turn up / not careful / don't finish the job

3

[6]

Q19.

(a) (i) reduced photosynthesis

ignore growth

*do **not** allow need light for respiration*

1

(ii) less food (for animals) **or** less oxygen (for animals)

allow loss of habitat

1

(iii) any **two** from:

accept 2 physical factors or 2 biological factors or one of each for full marks

examples of physical factors, eg
- flooding
- drought
- ice age / temperature change

ignore pollution
- volcanic activity

examples of biological factors, eg
- (new) predators (allow hunters / poachers)
- (new) disease / named pathogen
- competition for food
- competition for mates
- cyclical nature of speciation
- isolation
- lack of habitat or habitat change

*If no other answers given allow natural disaster / climate change / weather change / catastrophic event / environmental change for **1** mark*

2

(b) (i) 3

1

(ii) fossils

ignore bones, remains, fossil fuels

1

(c) (i) 65 million years ago

1

(ii) 17

allow ecf

1

(iii) fossil record incomplete
or
some fossils destroyed

accept not enough evidence

or

cannot perform experiment to test

1

[9]

Q20.

(a) 160 000

if incorrect answer / no answer:

allow max. 2 for method:

1 mark for mean = total number ÷ area of ten quadrats

eg $\frac{20}{0.625}$ *or* $\frac{20 \times 8}{5}$ *or* $\frac{160}{5}$ *or 32*

1 mark for final answer = mean × field area

eg mean × 5000

3

(b) Improvement: place quadrats randomly
and
Reason: avoid bias / (more) representative / (more) reliable

allow 1 mark if 2 correct improvements but no reasons / only incorrect reasons

1

Improvement: more quadrats
and
Reason: overcome random variation / (more) typical / (more) representative / (more) reliable / repeatable

1

Improvement: larger quadrats **or** repeat when plants are bigger
and
Reason: less likely to miss plants

ignore accurate, valid, precise and fair

ignore anomalies

1

[6]

Q21.

(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]

Q22.

(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) <u>respiration</u> (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]

Q23.

(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]

Q24.

(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]

Q25.

(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]

Q26.

(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]

Q27.

(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]

Q28.

(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]

Q29.

(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]

Q30.

(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]

Q31.

(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]

Q32.

(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]

Q33.

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

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

1

(so) aerobic 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]

Q34.

(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]

Q35.

(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]

Q1.

(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]

Q2.

(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]

Q3.

(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]

Q4.

(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]

Q5.

(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]

Q6.

(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]

Q7.

(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]

Q8.

(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]

Q9.

(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]

Q10.

(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]

Q11.

(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]

Q12.

(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]

Q13.

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)

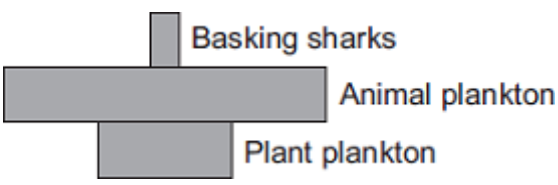
Examples of Biology points made in the response:

- (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]

Q14.

(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 <u>plant</u> (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]

Q15.

(a) chose places <u>randomly</u>

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]

Q16.

(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]

Q17.

(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]

Q18.

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]

Q19.

(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]

Q20.

(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

<u>aerobic respiration</u> 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]

Q21.

(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]

Q22.

(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]

Q23.

(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]

Q24.

(a) (i) 0.6 **or** 6 x 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 x 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]

Q25.

(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]

Q26.

(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]

Q27.

(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]

Q28.

(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]

Q29.

(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]

Q30.

(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]

Q31.

(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]

Q32.

(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]

Q33.

(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]

Q34.

(a) microorganisms

1

(b) moist

1

(c) respiration

1

(d) roots

1

[4]

Q35.

(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]

Q1.

(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]

Q2.

(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]

Q3.

(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 / <u>breakdown</u> / 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]

Q4.

(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]

Q5.

(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 <u>more</u>*

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]

Q6.

(a) methane
accept CH_4 / CH4 / CH^4 extras cancel

1

(b) **anaerobic** respiration **or** fermentation
ignore decay / decomposition / digestion
*do **not** allow aerobic*

1

(c) (i) in range 32 – 33

1

(ii) keep cool(er)
or keep below 40 (°C)
or insulate from heat
allow keep at optimum temperature if (c)(i) < 40

1

high(er) / optimum rate of biogas production
or rate decreases at higher temperatures
or works more efficiently
allow correct reference to rate of enzyme action eg high temperature would denature enzyme owtte

1

(d) increases rate / high rate
allow 'works better'

1

insulates / keeps warm
allow maintains optimum temperature

1

[7]

Q7.

(a) (i) **D**

1

(ii) **A**

1

(b) (i) air / oxygen (can enter)

ignore other factors entering or leaving

1

for (aerobic) respiration

*do **not** accept anaerobic respiration*

1

(ii) (more) minerals / nutrients /salt(s) / ions

or

named mineral / element available

ignore fertility / fertiliser

allow symbols

*allow eg mulching / reducing weeds **or** retain water*

1

[5]

Q8.

(a) (i) methane

apply list principle

allow symbols

1

(ii) anaerobic respiration / (anaerobic) fermentation

ignore decay / decomposition etc

1

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

- manure disposed of
- gains fertiliser (for crops)
- gets (free) fuel **or** cheap supply of energy **or** (free) cooking / heating / lighting

allow converse

allow not using wood / trees

- can sell crops at higher price

2

(ii) in the UK

allow converse arguments for Sri Lanka

lower temperature
or
not enough heat
ignore other factor(s)

1

process is slower
or
enzymes action slower
ignore references to efficiency / 'bacteria working'

1

[6]

Q9.

(a) microorganisms / bacteria / fungi / microbes
*allow named example **or** mould*
ignore decomposers unqualified / germs / maggots / worms

1

(b) it is warm(er) / hot / increased heat / increased temperature
ignore 'sun is hot' unqualified

1

(c) oxygen

1

[3]

Q10.

(a) 30
*award **both** marks for correct answer, irrespective of working*
*100 – (33 + 27 + 10) or equivalent for **1** mark*

2

(b) 2 **or** 1.98
*award **both** marks for correct answer, irrespective of working*
*(33 / 100) × 6 or <u>equivalent</u> for **1** mark*

2

(c) respiration

1

(d) (i) less / no heat loss / movement
*do **not** accept 'energy' / warmth unqualified*

1

(ii) any reference to cruelty eg stress to calf / cramped conditions
ignore references to disease / hygiene

1

[7]

Q11.

(a) methane

1

(b) (insulation maintains) higher temperature / warm(er) /
keeps heat in / prevents heat loss / optimum temperature /
heat increases rate of reaction

*do **not** allow hot(ter) / high temperature*

ignore same / constant temperature

1

(c) (i) ($)25 000

ignore units
ignore working or lack of working

add 3 figures and subtract 10 000

or

*use of 35 000 and 10 000 but wrong answer for **1** mark*

2

(c) (ii) 8 years = **2** marks

ignore working or lack of working

or

correct answer from (c)(i) = **2** marks

$\frac{200000}{(c)(i)}$ *but wrong answer = **1** mark*

2

[6]

Q12.

(a) (i) 20

1

(ii) 12000

1

(b) area of strips

or

length / width / size of transect

or

number of transects

1

(c) (i) since squirrels mobile

or

squirrels could be counted twice

or

squirrels hide

1

(ii) any **two** from:

- numbers of larders observed likely to be lower than actual
  *do **not** accept squirrels share larders or squirrels have more than one larder*
- since unlikely that all could be spotted if 5 m away
- old larder
- squirrels moved on / died
- young squirrels
- haven't made a larder

2

(d) (i) 0 to 6.8

1

(ii) any **one** from:
*do **not** accept squirrels prefer blue spruce*

- squirrels prefer blue spruce cones / seeds / nuts as food
- more cones / food
- more nesting sites
- fewer predators / competitors

1

[8]

Q13.

(a) any **two** from:
control variables from information given

- area of bed sampled
- sampling time
- size of net
- kicking action
- net position

2

(b) any **two** from:

must be ideas related to a sample

- some animals not dislodged
  ignore reliability etc
- some animals missed / through / escaped net
- invertebrates difficult to identify
- invertebrates from outside area

2

(c) 10 to 99 **or** 10 – 99 **or** 99 to 10 **or** 99 – 10

1

(d) any **two** from:

- increased / goes up
  allow increase implied from all data described
- 0 at sample 4
- to (more than) 100

2

(e) mayfly

1

because not found downstream of point where sewage enters stream **or** only in the unpolluted water

1

[9]

Q14.

(a) points plotted accurately

$+\frac{1}{2}$ *square*

deduct 1 mark per error
ignore the line

2

(b) 30 **or** correct from candidate's graph

accept 30 000 lynx
*do **not** accept 30 000*

1

(c) (i) fall

mark (i) and (ii) separately

1

(ii) fewer hares **or** lack of food

*do **not** accept <u>no</u> hares or food*

1

(d) kills / preys / preys on / hunts / catches
<u>and</u> eats / for food (other) animals

*must have the eat **and** kill for the point*

1

[6]

Q15.

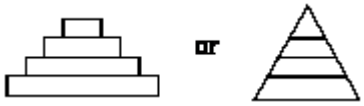
(a) 0.1

ignore working or lack of working

$\frac{88 \times 100}{88\,000}$ *for 1 mark*

2

(b) <u>shape</u>: pyramid with 4 tiers



1

<u>labels:</u>

Plants + Herbivores + Carnivores + Top carnivores
(in sequence – largest to smallest)

allow suitable named examples

*inverted pyramid correctly labelled = **1** mark*

1

(c) more energy / biomass / materials / matter available or less energy lost or energy used up (by herbivores)

***not** just plants*

1

[5]

Q16.

(a) any **three** from:

1960: $\frac{132}{186} \times 100$

71(%)

1970: $\frac{161}{247} \times 100$

65(%)

*if both correct – **3** marks*
*if one correct – **2** marks*
*if neither correct – check working – **1** mark each*

3

(b) **advantages (maximum 3 marks)**

reduced use of coal / oil / non renewable / fossil fuels

less smoke / sulphur dioxide
ignore pollution

cheaper in long term / over 8+ years / few years

(energy) self-sufficiency idea

fertiliser to help crop growth
accept less fertiliser bought

means of waste disposal
accept any other appropriate responses

disadvantages (maximum 3 marks)

high initial cost

explosion risk

technical **or** training required
accept any other appropriate responses

max 4

(c) (i) suitable scales;
S

1

all plots accurate;
P

1

suitable curve **or** ruled dot-to-dot **or** straight line of best fit
L
*do **not** accept lines through origin line must not be thicker than half square*

1

(ii) insulation / less temperature variation / maintain temperature
*do **not** accept 'kept cool' **or** 'warm'*

1

less chance of microbes being killed /
enzymes denatured **or** keep at optimum
temperature **or** maintain high gas production

1

[12]

Q17.

(a) In sequence:

heron
frog
slug
lettuce

1

(b) (i) light / sun

ignore photosynthesis / respiration
cancel mark if water / ions etc given
*do **not** accept heat*

1

(ii) traps / absorbs light

accept energy for light
*do **not** accept collects / attracts*
*do **not** accept 'traps sun'*

1

(iii) 162

if correct answer, ignore working / lack of working

$\frac{10 \times 1620}{100}$ *for **1** mark*

2

[5]

Q18.

(a) **X** (no mark)

X is more visible **or Y** is more camouflaged

1

(b) (i) so camouflage not changed **or** so not easier to see

1

(ii) 25

1

7

1

(iii) any **one** from:

- eaten (by birds) / died
- mixed in with large number of unmarked moths
- moved away

1

(c) (i) DNA

1

(ii) the gene / allele for being dark / dominant

1

[7]

Q19.

(a) **Quality of written communication**:
ideas given in a sensible order

broken down
giving products (could be CO_2, minerals or gas)
(used by trees)
Q ✓ or Q ✗

1

any **three** from:

- microorganisms / bacteria / fungi / saprotrophs
- accept saprophytes / saprobionts / detritivores (named)
- digest / break down organic matter / leaves / decompose / reference decomposers / decay / rot
- use of enzymes / correct named example
- absorption by diffusion / active transport
- must be of breakdown products
- respiration / combustion
- release of carbon dioxide

CO_2 can be used (by trees) in photosynthesis
*do **not** accept CO_2 taken in by roots*

3

(b) any **two** from:

- warmth / suitable temperature
  *do **not** accept heat / hot weather*
- damp / water / rain / humid / moisture
- oxygen
- suitable pH

2

[6]

Q20.

(a) (i) (predator) lion

1

(prey) antelope

1

(ii) light

accept other positive indications

1

(iii) in sequence (top to bottom):

lion
antelope
grass

1

(b) (i) bacteria / fungi / saprotrophs

accept moulds / decomposers / microorganisms / microbes / saprophytes / saprobionts

1

(ii) aerobic

1

moist

1

warm

accept other positive indications1

1

(iii) carbon dioxide

1

mineral salts

1

[10]

Q21.

(a) 1.67 / $1\frac{2}{3}$

accept 1.6 to 1.7

ignore working or lack of working $\frac{400 \times 100}{24000}$ *for **1** mark*

2

(b) any **three** from:

deduct only 1 mark for any mention of in carnivore

lost as heat **or** keeping body warm

lost in metabolic functions is not enough

lost in respiration

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

movement

not eaten parts or individuals / non-edible parts / dead leaves / wood / bones / faeces / urine

ignore 'waste'

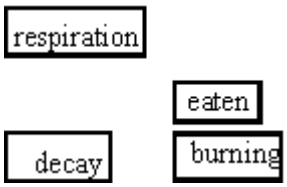
ignore references to growth / reproduction

3

[5]

Q22.

(a) **1** mark for each



4

(b) (i) digests **or** breaks down **or** decays dead (organic) material

accept rots for digests

accept plants for dead organic material

*do **not** accept 'live on' **or** 'decompose'*

1

(ii) bacteria **or** worms **or** maggots

*accept microbes but **not** germs **or** viruses*

1

[6]

Q23.

(a) (i) squirrels eat nuts;

each for 1 mark

owls eat squirrels

(2 marks for energy flow)

2

(ii) hazel tree

gains 1 mark

1

(iii) 1 squirrel population would decrease; because fewer nuts available as food

each for 1 mark

2

2 owl population would decrease; because fewer squirrels available as food

each for 1 mark

2

(b) (i) digested/broken down;

(ii) by microbes/reference to worm action;

each for 1 mark

2

(iii) March
warmer/increased activity of worms/microbes;

each for 1 mark

2

[11]

Q24.

(a) (i) vole/small bird/beetle

gains 1 mark

1

(ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small

each for 1 mark

3

(b) 8 of:
energy stored in chemicals in cells/tissues/growth;
passed up food chain;
less energy stored at each stage in food chain/pyramid level;
because only part of energy taken in used for growth;
some lost in waste;
some used for repair;
used to main body systems;
some lost in respiration;
some converted into other forms of energy;
e.g. movement;
much lost as heat;
by time detritus feeders have used remains;
all returned to environment

each for 1 mark

8

c1 → animals
c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

Q25.

(a) e.g.:
competition for light because potamogeton plants taller
competition for nutrients taller plants may have longer roots

each for 1 mark

4

(b) descriptions of:
measuring tape or similar quadrat
method of estimating cover (inside quadrat)

each for 1 mark

3

[7]

Q26.

(a) water

gains 1 mark

oxygen

gains 1 mark

2

(b) e.g.:
some materials/energy lost in animals' waste materials
respiration releases energy
some materials/energy used in maintenance/repair
some energy used for movement
much lost as heat to surroundings
some organisms die (rather than eaten)
reference to detritivors
reference to microbes

each for 1 mark

8

[10]

Q27.

(a) (i) e.g. mussels/caddis loach

for 1 mark

1

(ii) 3 of:
carbon dioxide
water
chlorophyll/chloroplasts
light

any 3 for 1 mark each

3

(b) 6 of e.g.
some plant/animal material not digested by consumers passes out with faeces
respiration releases energy used in movement lost as heat
some 'lower' organisms die energy transferred to decomposers/detritivores
thence to environment

any 6 for 1 mark each

6

[10]

Q28.

(a) glucose/sugar water

for 1 mark each

2

(b) (i) 204

for 1 mark

1

(ii) 49 **gains 2 marks**

(incorrect answer, but correct method gains 1)

2

(iii) 3 **gains 2 marks**

(incorrect answer, but correct method gains 1)

2

[7]

Q29.

(a) pyramid correct shape labelled

2

(b) warm
moist
oxygen

3

[5]

Q30.

(a) soil contains the microbes which will decay the dead material

for 1 mark each

2

(b) lets in air/oxygen oxygen speeds up decay process

for 1 mark each

2

[4]

Q31.

(a) levels in correct order
sizes correct

for 1 mark each

2

(b) (i) working
0.96% (correct answer = 2)

for 1 mark each

2

(ii) 2 of e.g.
heat up leaves
absorbed by non-photosynthetic parts
transmitted through leaves
any 2 for 1 mark each

2

(iii) 3 of e.g.
respiration of primary consumers
movement of p.c.
waste from p.c.
repair/growth of p.c.; heat losses to surroundings
any 3 for 1 mark each

3

[9]

Q32.

(a) 1 mark for each correct set of plots
for 1 mark each

2

(b) (i) number of voles/amount of food
for 1 mark

1

(ii) e.g. increased number of owls
new disease
for 1 mark each

2

[5]

Q33.

(a) (i) D

(ii) A

(iii) B
for 1 mark each

3

(b) W
for one mark

1

[4]

Q34.

<u>pros e.g.:</u>

gum trees survive therefore less soil erosion
therefore food webs not disrupted
if no culling, whole Koala population may die
easier to cull because Koalas are difficult to catch

cons e.g.:

Koala's 'right to life' / ethical issue
better to transfer to reserves on mainland than kill
could use tranquillisers to catch without killing
could allow population to stabilise naturally

max 4 of the above; max 3 pros or cons.

[4]

Q35.

(i) 0.25 × 100 / 25

gains 1 mark

but
1%

gains 2 marks

2

(ii) muscle contraction / limb movement / moving around / chewing
heartbeat / breathing / internal muscle activity
maintaining body temperature / keeps body warm
active uptake synthesising substances (*reject* growth)

any three for 1 mark each

3

[5]

Q1.

decay

1

warm (*)

1

moist (*)

1

grow

(*) these words can be either order

1

[4]

Q2.

(a) **Quality of Written Communication**

The answer to this question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

max 2 if ideas not well expressed

in summer more greenfly

accept increase in population

1

in winter less greenfly

accept decrease in population

1

over the three years greenfly numbers decrease

*accept fall **or** drop for decrease*

1

(b) any **one** from

(number of) greenfly

severe **or** cold winters
toxic chemicals
destruction of habitats
disease
predators
weather
temperature

do not accept food

1

[4]

Q3.

Quality of written communication: One mark for using correct scientific

terms microorganisms and respiration

1

(air contains) oxygen

1

(microorganisms break down human waste) by respiration (which releases carbon dioxide)

1

[3]

Q4.

any **five** from:

- the amount of energy (in the biomass of organisms) is reduced at each successive stage in a food chain
- all of prey organism is not consumed
- energy is 'lost' as the organisms' waste materials
- energy is transferred / lost during respiration
- energy is transferred / lost as movement (kinetic energy)
- energy is transferred / lost as heat (thermal energy)
- energy is transferred / lost to the surroundings
- the only energy transferred to a higher level is that which the organisms have used in growing

statements about energy flow the wrong way are neutral

[5]

Q5.

(a) all bars correct for greenfly, ladybird (± one square) and blackbird (less than one square)

1

bars are centred

*do not accept pyramid shape if **all** to left or right of centre*

1

bars are labelled (in correct sequence)

1

(b) $\frac{1}{12}$ **or** 8.3% **or** 1:12

if answer is incorrect accept correct working out (eg $\frac{50}{600}$) for 1 mark
accept 12 or 12:1 for 1 mark
accept 8.3 for 1 mark (without %)

2

[5]

Q6.

(a) 115

1

(b) any **four** from

less energy lost / used

as heat lost to the atmosphere

since warm indoors

accept temperature controlled

(less energy lost) in movement

since movement restricted

more growth / eggs

*accept prevents loss of body mass **or** gets fatter / weight gain*

4

[5]

Q7.

(a) any **three** from

different factors are required for each mark

hares breeding

(amount) of food **or** plants available

eaten by lynx **or** predators **or** reference to size of lynx / predator population

hares dying **or** reference to being killed by humans

disease (spreads through the population)

(competition) for space **or** (lack of) space)

*alternative to either of these points but not both change in environment **or** habitat*

temperature **or** weather **or** climate

3

(b) any **two** from

more food **or** hares for lynx encourages more breeding (in lynx)

accept less food, less breeding

more food **or** hares allows greater survival rate of cubs **or** adult lynx

accept less food, less survival

idea of time lag for breeding **or** time lag for dying

2

[5]

Q8.

(a) (i) photosynthesis

1

(ii) respiration

do not credit combustion

do not credit decay

1

(iii) dry

*accept hot **or** windy **or** drought*

1

(b) any **three** from

* evaporation (of water)

***or** loss of water vapour*

* (mostly) from the leaf / leaves

do not credit incorrect reference to leaves

* through the stomata

accept through each stoma

accept through the stomas(sic)

* causing a pull

***or** causing an increase in osmotic potential (at the top of the plant)*
***or** causing an increase in water potential (at the top of the plant) **or** causing a decrease in osmotic pressure (at the top of the plant)*

* (so that) water moves up (through the plant)

do not credit water vapour moves up through the plant

* as the transpiration stream

* water enters through roots (and goes up plants)

3

[6]

Q9.

(a) evaporates

1

sea

1

sun

accept sun

1

wind

1

condenses

1

rain

1

(b) (i) carbon dioxide

accept CO_2 provided it is correct in every detail

1

(ii) (process) D

1

millions of years

a million years upwards

1

[9]

Q10.

(a) diatoms photosynthesise **or** are producers

1

the amount of growth depends upon the energy **or** light they get

accept more light means more growth
***or** they multiply more in more light*
do not accept they need light

1

(b) (i) eaten by small fish

do not accept eaten by fish

1

minerals **or** nitrate **or** phosphates
or nutrients **or** food supply used up
or reduced

1

(ii) any **two** from

gets colder
light decreases
end of their life span **or** die

accept more being eaten than being formed

eaten by small fish

do not accept a decrease in nitrates

or *phosphates*

1

(c) increased minerals **or** nitrates **or** phosphates

1

any **one** from

due to death **or** decay of diatoms **or** fish

do not accept death of large fish

1

influx of minerals in an ocean current

*do not accept extraneous pollution **or** dumping by a ship*

1

[8]

Q11.

(a) more oxygen/microbes more active

1

(b) plenty of microbes
moisture/not too wet
warmth food for microbes

any 2 for 1 mark each

2

[3]

Q12.

(a) (i) predator (allow carnivore)

(ii) prey

each for 1 mark

2

(b) fewer ladybirds; because less food/ladybirds starve
or
no change; because alternative food supply

each for 1 mark

2

(c) any two suitable environmental effects e.g.
food;
diseases;
other predators;
space;
insecticides

any two for 1 mark each

2

[6]

Q13.

(a) warmth/heat
oxygen/air
moisture
microbes/micro-organisms/fungi/moulds/bacteria

any three for 1 mark each

3

(b) do not rot

for 1 mark

1

[4]

Q14.

(a) *idea:*
wood goodness recycled/crops goodness removed

gains 1 mark

1

but
wood minerals/nutrients recycled/crops remove nutrients/minerals

gains 2 marks

wood and crops compared

for 1 mark

2

(b) (add) fertiliser/nutrients/minerals
(add) manure/animal waste/compost

any two for 1 mark each

(accept move to new area for 1 mark)
rotation

max marks 2

2

[5]

Q15.

(a) (i) carbohydrate*/fat/protein in cell
(or example e.g. glucose/starch)

for 1 mark

1

(ii) $\frac{21500}{1050000} \times 100$ or 2.(05)%

for 1 mark

1

(b) *ideas that:*
little energy used for growth/most wasted/lost
gains 1 mark

but
only 4% used for new growth
gains 2 marks

evidence/idea that this is repeated at each stage
idea of diminishing return/less energy at each stage
for 1 mark each
(maximum of 3)

3

(c) *idea:*
plants at the start of all food chains
shorter food chain
more efficient/less energy lost/more food
cheaper/more economic
(must bear consequence of at least one of earlier marks)
any three for 1 mark each

3

[8]

Q16.

(a) microbes/worms/bacteria/fungi/moulds/
micro-organisms/decomposers
(not germs/bugs/slugs/organisms - ignore these)
any one for 1 mark

1

(b) idea warm/hot/heat (not sun)
oxygen/air
moist/water/wet/rain (not 'turn the compost' unless qualified)
If no answer given in (a), one e.g. could be credited in (b)
any two in any order for 1 mark each

2

[3]

Q17.

(a) (i) methane/biogas/natural gas
(accept formula) for 1 mark

1

(ii) cooking/heating/burning/fuel/vehicle fuel/lighting
for 1 mark

1

(b) *idea that* it is a soil improver/fertiliser/provides nutrients or makes soil richer
or improves plant growth/makes plants grow better
(not "plants" alone/gardens/spreading on land)

for 1 mark

1

[3]

Q18.

(a) predator/carnivore

(not consumer/hunter)

for 1 mark

1

(b) (i) number decrease
not 'no' less food (for large mites)/less prey/fewer small mites to eat
(not 'fewer small mites' etc)
starve/cannot grow/cannot breed/die/die out

each for 1 mark

3

(ii) increase small mites breeding faster (than they are eaten)

each for 1 mark

(accept different food found)
decrease = O maths but 1 mark for possible reason can be awarded - more (small mites) eaten

each for 1 mark

2

[6]

Q19.

(a) *idea:*
soil wetter
soil less aerated
less food for moles/voles/foxes/badgers/birds
soil less fertile (less leaves in soil not enough on its own)
less food grown
earthworms die out/fewer earthworms
(not just "earthworms get eaten")

any 4 for 1 mark each

4

(b) method
advantage
disadvantage
*e.g.**

- chemical
- kills worm/affects reproduction/maintains earthworm population
- persistent/food chain/kill earthworm

or

- import biological central/predator/disease/parasite

- kills worm/affects reproduction/maintains earthworm population
- may attack other animals/cause same sort of problems as New Zealand worms

(* credit other plausible suggestions for method/advantage/disadvantage)
for 1 mark each

3

[7]

Q20.

idea that

microbes/bacteria/fungi/moulds/micro-organisms/decomposers.
NOT germs/worms/bugs/organisms
gains 1 mark

but microbes etc. need/grow/cause decay/decompose in
gains 2 marks

but microbes etc. need/grow/caused decay/decompose faster in warm/moist conditions
gains 3 marks

(Allow reverse arguments)

[3]

Q21.

(a) predator
prey
no alternatives
for 1 mark each

2

(b) *idea that*
(wasps) increase OR decrease
gains 1 mark

but
(wasps) increase then decrease/peaks at
gains 2 marks
answers must match

idea of change in food supply/whiteflies
more food/whiteflies OR less food/ whiteflies
gains 1 mark

but
more food/whiteflies then less food/whiteflies
gains 2 marks

or
wasps follow trend in whiteflies
for 2 marks

or
linked to increase/decrease other environmental effects
e.g. more/less food for wasps, use of insecticide
e.g. temperature change, other predator
If increase/decrease not given then second part (reason) gains no marks
for 1 mark each

4

(c) *idea that*
wasps die out/die off/fly away/migrate/leave greenhouse but NOT 'die' alone
for 1 mark

1

[7]

Q22.

Factor and effect needed.
idea

- killed by poachers (for tusks/ivory)
- not enough food for elephants because humans cut down trees
- not enough space because more used by people/agriculture
- food/space destroyed by humans
- killed for food

any three for 1 mark each

[3]

Q23.

(a) (i) (tiny green) plants / phytoplankton
for 1 mark

1

(ii)
- penguin
- shrimp
- cod
- squid

any two for 1 mark

1

(b) <u>Decrease:</u> seals will eat more squid and penguins
for 1 mark

1

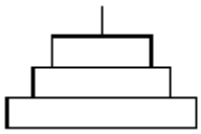
Stay the same:

- more shrimp for squid and penguins
- squid and penguins increase balances the extra eaten by seals
- seals find other prey [allow shrimps]

any two for 1 mark each

2

(c)



credit  *for seal*

allow 

- correct / shape (designs need to be to scale)
- correctly labelled with organisms

(if wholly correct but inverted then credit 1 mark)

each for 1 mark

2

[7]

Q24.

(a) photosynthesis

for 1 mark

1

(b)
- grass eaten by rabbit
- rabbit eaten by fox
- carbon becomes part of fats/proteins in the fox's body
- or passes along the chain as (carbohydrate) / fat / protein

each for 1 mark
[Do not accept 'carbon gets into fox's body', for third mark]

3

[4]

Q25.

(a) Decrease: seals will eat more squid and penguins

for 1 mark

1

Stay the same:

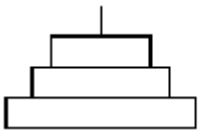
- more shrimp/food for squid and penguins

ideas that

- increase in squid and penguins balances the extra eaten by seals
- seals find other prey (allow start to eat shrimps)

any two for one mark each

2

(b) 

credit  *for seal*

allow 

- correct shape (doesn't need to be to scale)
- correctly with organisms

(if wholly correct but inverted then credit 1 mark)

each for 1 mark

2

(c)
- seals are mammals
- *idea that* seals have (to maintain) a constant body temperature *[allow warm blooded]*
- heat losses to cold seas
- more of food eaten used to replace heat loss

(credit use of figures i.e. 95% loss compared to 90%
or 5% efficient compared to 10%
or 20 : 1 conversion ratio compared to 10 : 1
with 1 mark)

any three for 1 mark each

3

(d) (i) *ideas that*

- reduce number of fishing boats allowed

- breed in captivity and then release
- agree quotas [not an unqualified 'ban']
- avoid breeding areas
- avoid breeding seasons
- increase size of net mesh/don't catch small fish
- limit catches of shrimps
- cull seals

any two for 1 mark each
[allow any other reasonable answer]

2

(ii)
- breeding areas closer to some countries than others
- difficult to police/easy to cheat/'poach'
- difficult to agree quotas
- some countries eat more fish than others
- best weather for fishing maybe in breeding seasons
- fisherman/trawlers need employment
- big demand for cod

any one for 1 mark
[allow any other sensible response]

1

[11]

Q26.

(a) (i) (too) cold / all moisture / <u>water</u> frozen / no moisture / no warmth / conditions for decay are absent.

for 1 mark

(*No* oxygen is neutral)
(*Do not accept* frozen or ice has preserved them)

1

(ii)
- (bacteria have) no oxygen / air (because dead fish covered in mud)

(No moisture x)

(No moisture and no oxygen or warmth x)

- bones / hard parts do not decay easily

idea that

- material of fish replaced by minerals

any two for 1 mark each

2

(b) *ideas that*

- mammoths lived at the same time as humans / there was man in these times
- mammoths lived in the same place as humans
- humans hunted mammoths / ate mammoths / were carnivorous / for fur etc
- reference to later use of more advanced weapons
- humans needed to protect themselves from mammoths
- humans used flints / weapons / tools

any two for 1 mark each

2

(c) *idea that*

- environment changed / became too cold / became too warm / vegetation changed / humans destroyed environment
- (new) predator / humans killed them
- new disease
- new competitor / type of elephant
- shortage of food / no food / ran out of prey
- mammoths reproduced too slowly
- mammoths didn't adapt to changes

any two for 1 mark each

2

[7]

Q27.

(a) • warmth / heat / hot / not cold if refer to weather or conditions outside the compost heap, *do not allow*

• moisture / water

• air / oxygen (*allow idea that* not squashed down)

in any order for 1 mark each

3

(b) *idea that* nutrients / minerals / nitrates are recycled / fertilise the soil (*do not allow* food / goodness)

for 1 mark

1

[4]

Q28.

(a) idea that

- light doesn't reach deeper parts
- plants need / absorb light
- to make food

gain 1 mark each to maximum of 2

but

so they can photosynthesise

gains 2 marks

2

(b) herring will be on the bottom
herring follow / will be feeding on the copepods

independent marking points

for 1 mark each

2

[4]

Q29.

(a) prey

for 1 mark

1

(b)
- disease
- eaten (by predators) / predators
- (over)fished / caught by fishermen
- competition for food / not enough food (for all the baby fish) / no food

(*do not allow* they migrate or move elsewhere)

any three for 1 mark each

3

[4]