AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.7.2 ORGANISATION OF AN ECOSYSTEM (PACK 1)

SCORE	PERCENTAGE
/335	%

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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:

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- 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]

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Q3.

(a)

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

1

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

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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

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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

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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

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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

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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)*

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*__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

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***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

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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

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(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

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- 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

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(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:

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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

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- 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]

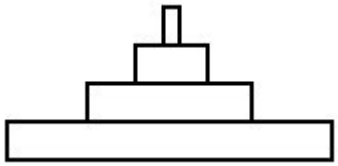
Q14.

(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

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(b) 

1

(c) 15(%)

$\frac{3 \times 100}{20}$ *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

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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*

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- 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

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(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

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(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*

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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

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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

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(ii) light needed for photosynthesis

1

for making food / sugar / etc.

1

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

1

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

1

(algae / plants) block light

1

(low light) causes algae / plants to die

1

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

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

1

(aerobic) respiration (by microbes) uses O_2

*do **not** allow anaerobic*

1

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

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

ignore chemicals unqualified

ignore waste unqualified

ignore human waste / domestic waste / industrial waste unqualified

1

(d) (i) 2

1

(ii) more food

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

1

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

allow fewer species in more polluted water

ignore none are found at site C

1

[19]

Q23.

(a) any **two** from:

- amount of waste on each heap

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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

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- 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

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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:

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- 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

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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

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(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]

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

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

1

producing CO_2 (which does not burn)

accept there is no methane
ignore inflammable

1

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

answer must be comparative

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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)*

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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]

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