Mark schemes

1

(a) snail
or
shrew

additional incorrect answer negates correct answer

1

(b) shrew

additional incorrect answer negates correct answer

1

(c) fewer shrews to eat them

1

(d) population

1

(e) **C**

1

(f) (11 000 × 0.1 =)
1 100 (kJ)

1

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

1

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

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

1

[8]

2

(a) (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]

3 (a) an extremophile species

1

(b) (i) smaller ice area

allow smaller amount of ice

allow less ice

1

(so) less habitat

allow fewer places to live / nest

1

(ii) **either** increase
as more sea to live in
or
as less competition for food

or decrease
as less space (ice) to lay eggs
or
predators more likely to eat them

there is no mark for increase / decrease alone. The mark is for an appropriate reason linked to increase / decrease

if increase / decrease not ringed the mark may be awarded if it is clear in the explanation which is intended

1

(c) Living organisms show long-term changes.

1

[5]

4 (a) (i) any **one** from:

ignore references to same lawn / weather / soil, which are not given in the question.

- (same) (type of) weed killer
- (same) volume / 5dm^3 of solution used (on each area)

allow amount of solution used

*do **not** allow amount / volume / concentration of weed killer*

*do **not** allow number of daisy plants*

- effect on daisies (not other weeds / plants)
- (same) area / 10m^2
- (same) time **or** (effect after) two weeks.

1

(ii) more (daisies) growing after use of weed killer **or** after two weeks

allow it does not fit pattern (of other results)

1

(iii) any **one** from:

ignore to see if it / water has an effect

- as a control

*do **not** allow as a control variable*

- to compare (to the other areas)
- to check other factor(s) are not affecting the results / daisies.

1

(iv) 80 (arbitrary units of weed killer) also killed all the daisies

allow ref to possible experimental design flaws such as 'only tested once' or 'not repeated' or 'different number of daisies in each area at first'

allow idea that other weed species may not respond in the same way as daisies

allow idea that 100 (units) may also kill wanted species / grass

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 refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1−2 marks)
Reference to at least one environmental factor plants respond to
or
at least one response
or
a named hormone

Level 2 (3−4 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
or
reference to a named hormone
and
at least one associated response

Level 3 (5−6 marks)
Reference to at least one environmental factor plants respond to
and
at least one associated response
and
reference to a named hormone

Examples of biology points made in the response:

environmental factors

- light

  allow phototropism
- (direction of the force of) gravity

  allow gravi / geotropism
- moisture / water.

  allow hydrotropism

effects on direction of growth

- shoots grow upwards
- shoots grow towards light
- shoots grow against (the force of) gravity
- roots grow downwards
- roots grow towards moisture
- roots grow towards (the force of) gravity.

  allow reference to 'positive' and 'negative' in terms of tropisms as indicating direction of growth

hormone

- reference to auxin

  allow other named hormone(s)
- unequal distribution of hormone causes unequal growth (rates).

  allow higher concentration of hormone causes faster growth in shoots

  allow higher concentration of hormone causes slower growth in roots

6

[10]

5 (a) gets more light (near surface)

allow warmer (near surface)

allow bladders contain (more) carbon dioxide

1

(so) photosynthesises more

1

(because) bladders aid floating (when tide is in)

or

(so) more biomass / glucose / starch produced

*ref to 'more' needed only once, eg gets more light for photosynthesis gains **two** marks*

if 'more' not given do not award mark on the first occasion

1

(b) lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)
or
lets angler fish see / attract prey to get food
or
lets angler fish see / attract mates to reproduce
or
lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain **two** marks*

2

[5]

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

- blackbirds seen in higher % of / more gardens
- multiplying mean number by percentage of gardens seen in shows blackbird is higher

  *allow **1** additional mark for correct figures showing this, ie 264 sparrows: 305 blackbirds*
- only done on one day / month / hour

  eg only done in January
- only done in gardens (one bird may prefer a different habitat)
- problem of (correct) identification
- may re-count same ones

  if neither point 5 or 6 given allow 1 mark for idea of error / miscounted
- people may quote false numbers / may make it up

3

(b) (i) 60.3

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

*award **1** mark for 33.5 + (33.5 × 80 / 100) or equivalent with no answer or incorrect answer **or** award **1** mark for 26.8*

2

(ii) any **two** from:

- change in temperature

  a comparison is required

  eg cooler / warmer / less frost (in 2012)
- fewer predators
- more food **or** less competition for food
- more nesting space **or** less competition for nesting space
- less disease (in 2012)

  allow idea that people may be better / worse at identifying birds / goldfinches

  allow idea of movement to gardens (due to poor food supply elsewhere)

2

[7]

7 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 and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1−2 marks)
The apparatus needed to measure the leaf is identified
or
the apparatus needed to measure light intensity is identified
or
an appropriate use of the tape measure is identified.

Level 2 (3−4 marks)
There is a description of a leaf being measured at different locations
or
light being measured at different locations.

Level 3 (5−6 marks)
There is a description of a leaf **and** light being measured at different locations
and
repetitions are included
or
a control variable is described
or
appropriate mathematical treatment of the data is described.

Examples of points made in the response:
- use of tape measure to produce transect
- transect placed coming out of shady area (e.g. woodland) into lighter area
- repeat transects
- samples at same height above ground
- samples at same aspect (N / E / S / W) on trees
- measurement of length, or width, of leaves using ruler
- measure several leaves at each location
- use of light meter to measure light intensity
- repeat measurements of light intensity on several days
- measure light intensities at same time of day
- calculate mean for each location
- plot graph of mean leaf length, or width, vs. light intensity.

allow attempt to overcome other variables − eg soil water / soil pH / temperature

[6]

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

- parts of organisms have not decayed
  accept in amber / resin
  allow bones are preserved
- conditions needed for decay are absent
  accept appropriate examples, eg acidic in bogs / lack of oxygen
- parts of the organism are replaced by other materials as they decay
  accept mineralised
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
  allow imprint or marking of organism

3

(b) (i) teeth for biting (prey)
must give structure + explanation

1

claws to grip (prey)
accept sensible uses

1

wing / tail for flight to find (prey)

1

(ii) any **two** from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
  accept climate change
  allow change in weather
- prey dies out **or** lack of food
  allow hunted to extinction

2

[8]

9 (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]

10 (a) (i) chloroplast

1

(ii) cell wall

1

(b) (i) osmosis

accept diffusion

1

(ii) cell wall (prevents bursting)

1

(c) (i) carbon dioxide

allow correct formula

1

glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

11 (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]

12 (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]

13 (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies

or

one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible

1

(ii) remove solution / liquid (on outside of worm)
allow 'water'

1

(iii) variable amounts removed from each worm
ignore reference to length of timing

1

(iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals
allow reference to improve blotting technique eg blot before / blot more thoroughly

1

(b) (i) different (starting) masses / sizes / weights (at different concentrations)

1

allows comparisons / shows pattern / shows trend

1

(ii) (+)20
*correct answer = **2** marks, with or without working*
or

$$\frac{7.5}{37.5} \times 100 \quad / \quad \frac{7.5}{37.5} \quad / \quad \left(\frac{45.0}{37.5} - 1\right) \times 100$$

*for **1** mark*

2

(c) (i) graph:

points correct

allow ± 1 mm

*–**1** mark per error*

allow ecf from part b(ii)

2

label on x-axis including units – ie Concentration of salt in arbitrary units

1

line of best fit = smooth curve / ruled straight line

anomaly (4.0, –52) either plotted and ignored re. line

***or** not plotted*

do not allow point to point

allow best fit for ecf from 2bii

1

(ii) on graph:

ring drawn around point at (4.0, –52)

allow (5.0, –50) if cand. line indicates this

1

(iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% / different length of time in solutions / ref to error in blotting / balance not zeroed / error in weighing

allow some lugworms died

allow error in calculation

1

(d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1

1

value of no change in mass / worms in equilibrium with soln / described

allow small(est) mass change

1

(ii) water loss

1

by osmosis / diffusion

1

from dilute region in the worm to more concentrated solution outside

allow correct description in terms of high to low <u>water</u> concentration / high to low water potential

salt solution is hypertonic

concentration unqualified = salt concentration

1

[19]

14 (a) (i) traps light (energy)

allow uses light / converts light energy to chemical energy

1

for photosynthesis / for making sugar / starch / carbohydrates

ignore food

allow organic molecules

1

(ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot make its own glucose / carbohydrate

or

phloem has sugar / glucose / sucrose

accept amino acids / fatty acids / other small organic molecule

ignore takes food / minerals / water / nutrients

1

(iii) any **one** from:

- not enough sugar / nutrients to grow / respire

  accept not enough food to grow / respire
- might strangle / restrict growth by squeezing stem tightly
- may damage stem tissues by growing into it
- may smother leaves / block light **so** less photosynthesis / less growth

1

(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)
Description and explanation of an adaptation which only involves hooks **and** / **or** suckers.

Level 2 (3 – 4 marks)
Description and explanation of adaptations including hooks **and** / **or** suckers with any other adaptation **or** explanation.

Level 3 (5 – 6 marks)
Description of most correct adaptations **and** explanations.

Examples of biology points made in the response:

- hooks – for holding on / not being detached
- suckers – for holding on / not being detached
- flattened / large surface area – absorption of (large amounts of) food
- no gut – not needed as host digests food
- thick cuticle – protection from host's enzymes / so not digested
- large number of eggs – increased chance of infecting new host

allow hermaphrodite and self-fertilising – likely to be just one worm per host

internal fertilisation – gametes not digested

6

[10]

15 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 apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
At least **one** way in which animals **and** / **or** plants are adapted to survive.

Level 2 (3 – 4 marks)
A description of ways in which animals **and** / **or** plants are adapted **and** an attempt to link at least **one** adaptation to how it increases the chance of survival.

Level 3 (5 – 6 marks)
A description of ways in which animals **and** plants are adapted **and** a description of how at least **one** adaptation increases the chance of survival.

examples of biology points made in the response:

(animals)

(A) change / decrease in surface area / example
(decrease in surface area which) reduces area from which sweat / water may be lost

(A) hump with fat / fat stores
(fat in hump) to convert to water (via respiration)

(A) long eyelashes
(long eyelashes) to keep (wind-blown) dust out of eyes

(A) nocturnal / 'keep out of the sun'
reduce sweat loss (in heat of the day)

extra information

allow adaptations of specific animals to living in specified dry conditions, eg a desert

(A) change / increase in surface area / example
(increase in surface area which) increases area heat may be lost from (by radiation)

(A) changes to thickness of insulating coat
(thicker coat on upper surface) increases insulation from sun's heat

(A) thin (layer) / reduced amount of body fat
(reduced amount of body fat which) reduces insulating layer

(A) wide feet
(wide feet) to reduce pressure / spread weight / prevent sinking

(plants)

(A) decrease in surface area

(A) leaves are spikes
(reduced area / leaves are spikes) reduces water loss / transpiration / evaporation

(A) long / wide spread / extensive roots
(long / wide spread /extensive roots) to absorb (more) water

(A) fleshy / thick stem
(fleshy / thick stem) to store water

extra information

allow adaptations of specific plants to living in specified dry conditions, eg a desert

(A) thick wax
(thick wax) to reduce evaporation / water loss / transpiration

(A) few(er) stomata
(few stomata) to reduce evaporation / water loss / transpiration

[6]

16 (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]

17 (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]

18 (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

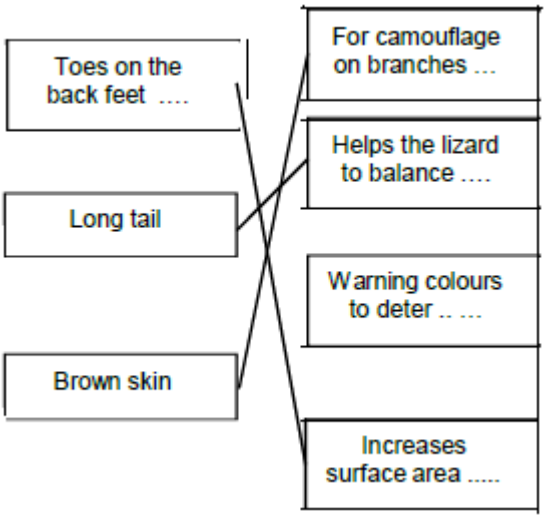
ignore reference to oxygen for respiration

'more' only needed once for 2 marks

1

[8]

19 (a)



one mark for each line

*do **not** award mark for an adaptation if lines are drawn from it to more than one advantage*

3

(b) escape (predators)

accept faster than swimming

allow chase prey

allow it stops them from drowning

1

(c) food

1

territory

1

*deduct **one** mark for each tick in excess of two*

[6]

20 (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]

21 (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]

22 (a) variation (between organisms within species)

allow described example

*allow mutation – but **not** if caused by change in conditions*

1

those most suited / fittest survive

1

genes / alleles passed on (to offspring / next generation)

allow mutation passed on

1

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

allow converse

- increase in latitude reduces number of (living) species

  ignore references to severity of conditions
- increase in latitude reduces time for evolution (of new species)
- the less the time to evolve the fewer the number of (living) species

2

(ii) any **two** from:

*do **not** accept intention or need to evolve*

- (increase in latitude reduces number of (living) species because) less food / habitats / more competition at high latitude

  allow only extremophiles / well-adapted species can survive

- (increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest

- (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive

2

[7]

23 (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]

24 (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]

25 (a) (i) any **two** from:
ignore oxygen / food / sun / carbon dioxide

- light
- water
- space
- nutrients / ions / minerals / named
*accept two named minerals / ions for **2** marks*

2

(ii) less competition for water

ignore space / light / food

or

more water / nutrients / minerals available

1

(b) camouflage / same shape as leaf / looks like a leaf

allow 'blends in'

ignore colour

1

[4]

26 (a) **1** mark for each adaptation and **1** mark for its correct linked advantage

- long / thick hair / fur (1) for insulation (1)

  allow keeps warm

- small ears (1) for reduced heat loss (1)
- small feet (1) for reduced heat loss (1)

  ignore wide feet

  ignore prevent sinking

- white fur / coat (1) for camouflage / poor emitter (1)
- small SA/V ratio (1) reduces heat loss (1)
- thick layer of fat (1) insulates / keeps warm (1)

Max 4

(b) **1** mark for an adaptation and **1** mark for its correct linked advantage

- horns (1) for defence (1)
- long legs (1) for speed / escape / vision (1)
- light colour (1) for camouflage (1)

  allow pattern

- eyes on side of head (1) for wider field of vision (1)
- hooves (1) for speed / escape (1)
- large ears (1) to hear predators better (1)

Max 2

[6]

27 (a) wing pattern similar to *Amauris*

allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*

*do **not** accept breeds with Amauris*

*do **not** accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]

28

(a) guard cell

ignore stoma / stomata

1

(b) Species A :

allow converse points for species B

stomata open in dark / at night **or** close in light / in day

1

stomata closed during warm(est) period **or** open when cool(er)

1

heat (energy) /warmth increases evaporation / transpiration

must give explicit link between heat and transpiration

1

reduces water loss / evaporation / transpiration

ignore photosynthesis

1

[5]

29

(a) any **two** from:

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

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

2

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

0 marks
No relevant content.

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

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

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

examples of biology points made in the response:

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

6

[8]

30

(a) any **three** from:

- streamlined shape enables it to swim quickly (to catch fish)
- wings (provide power) to move quickly (to catch fish)

  allow 'flippers'
- wings used for steering
- white underside / dark top acts as camouflage (so prey less likely to see it)
- long / sharp beak to catch fish

3

(b) any **three** from:

- reduces (total) surface area of penguins exposed to wind / cold atmosphere
- reduced number of penguins exposed (to wind / cold)

  accept reference to movement in or out of the huddle

  accept outer ones insulate / act as barrier
- reducing heat loss

  allow reduced cooling
- 'share' body warmth / heat

3

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

- size of tubes
- volume of (hot) water

accept amount of (hot) water

- left for same length of time

allow measured at same time intervals

- starting temperature

2

(ii) any **two** from:

- tube alone (**C**) lost heat most (rapidly)
- tube **B** intermediate
- tube **A** least (rapidly)

allow correct use of figures for all 3 tubes

ignore just quoting final temperature

2

(iii) confirms suggestion

no mark awarded

*accept correct answers referring to other suggestions in **(b)***

since (both outer and inner) tubes in bundle lost heat less rapidly (than 'stand − alone' tube)

comparison needed

1

penguins in a huddle lose less heat (than single ones)

accept 'it is the same for penguins'

1

(d) **if the core body temperature is too high**

blood vessels <u>supplying the skin</u> (capillaries) dilate / widen

*accept reference to arteries / arterioles but **not** veins / capillaries*
*do **not** accept references to movement of blood vessels*
ignore enlarge / expand
reference to skin / surface required only once

1

so that more blood flows through the (capillaries) in skin / near surface

*reference to 'more' needed at least once to gain **2** marks*

1

and more heat is lost

*reference to 'more' needed at least once to gain **2** marks*

1

if the core body temperature is too low

blood vessels <u>supplying the skin</u> (capillaries) constrict / narrow

allow full marks if 'too low' given first
*if no other marks awarded, allow vasodilation when too warm **and** vasoconstriction when too cold for **1** mark*

1

(e) (i) wings move to provide movement for diving

allow muscles contract / work

1

energy (for movement) comes from respiration

*do **not** allow produces / makes / creates energy*
allow energy comes from / is supplied by / is released by respiration

1

respiration / muscle contraction also releases heat

allow produces heat

1

(ii) any **three** from:

- feet not / less used **or** no muscle contraction in feet
  allow little energy / heat released through respiration in feet
  *do **not** allow veins / capillaries*
- vessels supplying feet constrict / less blood to feet
- so temperature in feet cools / decreases
- more heat loss from large surface area or rapid flow of cold water over foot

3

[22]

31 (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]

32 (a) looks like a leaf

1

so predator less likely to / won't see it

allow 'camouflage' as alternative to either point

1

(b) (i) thorns (of acacia tree) hurt (predators)

*allow idea that fewer animals / predators live in trees **or** ground living animals can't reach them (in the trees)*

1

(ii) (giraffe) avoids being bitten by ants

allow ants are poisonous / have unpleasant taste

1

(c) looks like / mimics a wasp **or** has warning colouration

1

so predators think it has a sting

1

[6]

33 (a) sulfur dioxide

1

(b) (i) mutation

1

(ii) pale form now (more) easily seen (by predators) **or** dark form now less easily seen (by predators)

accept ref to camouflage

1

so pale form (more) likely to be eaten **or** dark form less likely to be eaten

1

so dark form (more likely to) breed / pass on genes

or

pale form less likely to breed / pass on genes

1

(c) (i) pyramid of three layers of diminishing size

either way up

1

three labels in food chain order

award 2 marks only if the pyramid is correctly labelled

accept trees / birch

accept (peppered) moth(s) / larvae

1

(ii) some material is lost in waste from the birds

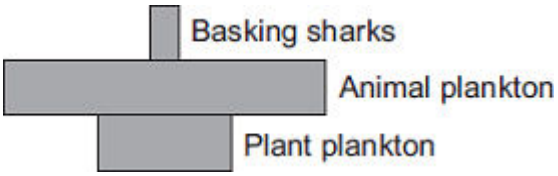
1

peppered moth larvae do not eat all the leaves from the trees

1

[9]

34 (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]

35 (a) C

1

(b) B

1

(c) E

1

(d) D

1

(e) F

1

[5]

36 (a) Scotland

1

any **one** from

- Scotland 15 to 20% / about 1/5 th to 1/7th but England and Wales / the others are less / lower / reasonable estimated figures
- $\frac{13.4}{79}$ is greater than England / $\frac{11.4}{130}$ and Wales / $\frac{2.8}{21}$

1

(b) (i) broadleaf woodlands have more grey squirrels **or** broadleaf woodlands have less red squirrels

allow converse referring to conifers

1

(ii) Wales has more conifers and / but more grey squirrels
or
Wales has less broadleaf and / but more grey squirrels

allow converse for red squirrels

1

(c) any **three** from:

answers must be comparative they = grey squirrels

grey squirrels

allow converse arguments for red squirrels

- have wid er range/ more types of food
- are resistant to parapox (virus) but reds are not

  ignore reference to other disease
- have more young each year / litter
- young more likely to survive (in mixed populations)

3

[7]

37 (a) brown (colour)

1

(b) (long) ears

1

(c) (long) horns

1

(d) (white) ring

1

[4]

38 (a) (soft) body parts / other parts / named parts

accept flesh

1

decayed / decomposed / rotted / eaten

or

bones do not decay / decompose / rot / get eaten

ignore disintegrated / dissolved

ignore microorganisms

1

(b) any **one** aquatic feature from: eg

- streamlined body shape
- long tail
- eyes on top of head
- scales
- fins / paddles / flippers / webbed feet
  ignore gills

1

any **one** terrestrial feature from:

- (front) legs / limbs / hands
- could lift front end upwards
  ignore feet
  *accept for **2** marks eg fin / flipper can be used for walking*
  ***or** fins like legs*

1

[4]

39 (a) (reduced) competition
ignore fighting

1

for any **one** from:

- light
  ignore Sun
- water
- nutrients / ions / salts / minerals
  ignore food
- space
  allow less overcrowding
- colonise new areas

1

(b) hooks
allow spines

1

attach to animals / human clothing / animals carry fruits long distances

ignore wind dispersal

1

[4]

40 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]

41 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 at least one example of an adaptation of either an animal **or** a plant. However it may not be clear how the adaptation helps the organism to avoid being eaten.

Level 2 (3-4 marks)
There is a description of an adaptation of at least one animal **and** at least one plant. It is clear how at least one of these adaptations helps the organism to avoid being eaten.

Level 3 (5-6 marks)
There are clear and detailed descriptions of a range of adaptations of named animals **and** named plants. It is clear how most of these adaptations help the organisms to avoid being eaten.

examples of clear and detailed biology points made in response:

- **camouflage** – the method of camouflage should be described plus a statement that the predator is less likely to see the prey
- **mimicry** / **warning colouration** – the method should be described plus a statement that the predator is likely to confuse the prey with e.g. a poisonous organism
- **thorns** / **prickles** / **spines** / **horns** – a statement that these are sharp and are likely to hurt a predator
- **long limbs** / **streamlining** – a statement that these increase speed and make it more likely that prey will outrun predator
- **bad taste** / **poison** – a statement that predator will find this unpleasant and 'spit out' prey / not attack same prey again
- **large ears** / **position of eyes** – a statement that predators will be detected earlier so the prey can escape sooner

[6]

42 (a) *answer to be marked as a whole*

has thorns / prickles / points

accept sharp points

1

(these) hurt animal

allow frighten animal

***only** accept prevent animal eating leaves if qualified by 'hurting' or 'frightening'*

1

(b) *answer to be marked as a whole*

camouflaged / looks like twig / disguised

allow blends in

ignore too small to see

1

(animal) cannot **see / detect** / recognise it

allow animal does not eat twigs

***only** accept prevents animal eating it if qualified by 'seeing' or 'wrong food'*

1

(c) *answer to be marked as a whole*

red / colour

1

warns that insect might be poisonous / dangerous

allow inedible / tastes bad

1

[6]

43 there are no / few predators of the lionfish
or spines protect lionfish from predation

allow warning colouration / poisonous

or no / fewer disease organisms

1

predators / prey in Atlantic do not recognise lionfish
or not fished by humans

allow high reproduction

1

also there is abundant food in Atlantic
or there is no / less competition in Atlantic

ignore adaptation to new environment

1

[3]

44 (a) large area

allow thin / large / big / flat / light

allow adaptations that cannot be seen eg internal air spaces

1

(b) (shape means that) snow falls off

1

(c) protect / stop it being eaten

1

(d) stores/ absorbs water (from other parts of the plant)

ignore absorbs water from soil / air

ignore nutrients

1

[4]

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

ignore size of dish

- colour of dish **or** all dishes black
- (same) amount of each seed
- position of dishes **or** all dishes in same place / garden

  ignore wood
- time observed / visited / left

2

(b) sunflower

1

(c) (i) (No)

named seed does not fit pattern

or

millet / safflower / corn eaten a lot but have little fat

or

the seed with the highest percentage eaten has least fat

accept converse

1

(ii) *allow separate references to sunflower and niger*

table 1 mark

- highest number of visitors **or** large range of visitors

  allow most popular

1

table 2 mark

- high percentage eaten

or

contain high fat for energy / insulation

allow most eaten

1

[6]

46 (a) (i) increased water uptake

ignore nutrients / food

allow quicker water uptake

allow collects water over larger area

1

(after) rain

accept ideas in terms of more successful competitor

1

(ii) water storage **or** stability **or** safety from predators

ignore absorption of water from soil

1

(b) reduces water loss / evaporation

accept reduces transpiration

allow stops water loss

1

wax protects plant **or** reflects heat **or** keeps plant cool **or** unpalatable

ignore reflects light

1

folding reduces surface area **or** folding reduces warming

*accept enclosed stomata **or** less exposure of stomata **or** increased humidity **or** less water concentration gradient*

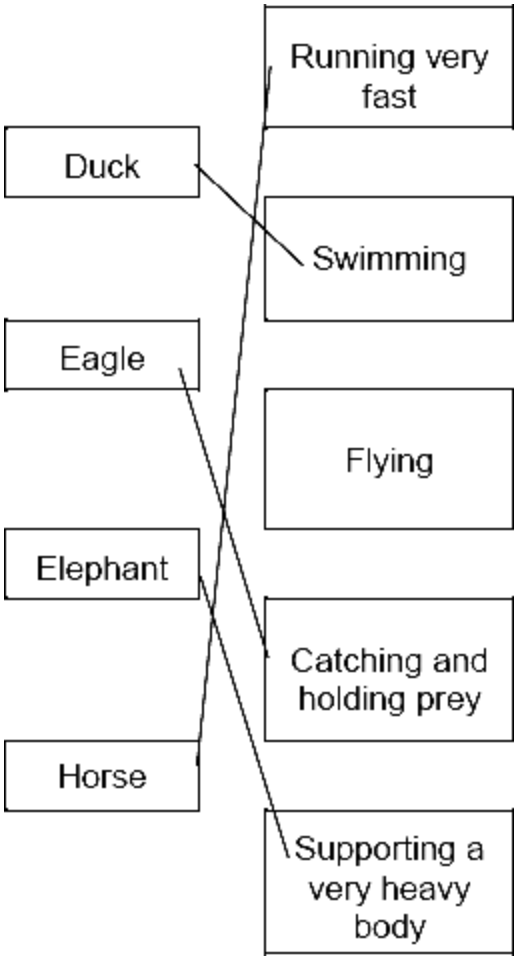
allow prevents burning

ignore less likely to be damaged

1

[6]

47



*all four correct = **4** marks*
*three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*
extra line from a statement cancels the mark

[4]

48

(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]

49 (a) camouflage / less visible

ignore insulation

1

(b) insulates / keeps warm

allow keeps out cold

ignore camouflage

1

(c) prey can't hear it / help catch prey /
cannot hear it so isn't scared away

ignore predation on owl

1

(d) catching / eating / killing prey /
perching / defence

1

[4]

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

- shorter distance between samples
  ignore repeat investigation /measurements
- sample to greater height
- specify the size of each site
  ignore longer transect

1

(b) (i) Parmelia

1

(ii) Evernia

1

(c) any **two** from:

- Lecanora does not extend over whole range of transect / does not grow everywhere /does not grow in town centre / does not grow in countryside
- Lecanora grows in a range of sulfur dioxide concentrations ***or*** Lecanora only grows in limited range of sulfur dioxide concentrations **or** Lecanora lives over large range of sulfur dioxide concentrations
- other factors eg different pollutant might also influence growth of Lecanora
- sulfur dioxide / pollutant concentration was not measured
  ignore Lecanora does not give accurate measure of sulfur dioxide concentration
- amount of Lecanora not measured

2

[5]

51 **1** mark for each adaptation and **1** mark for its correct **linked** advantage

fur / long hair / thick coat (1)

for insulation / reduces heat loss (1)
allow keeps warm for insulation point

large body / large mass / small (1) SA:V ratio
ignore layer of fat

retains heat / loses less heat (1)
ignore keeps warm

short legs (1)
reject short (height) / small (height)

reduces surface area / heat loss (1)
ignore keeps warm for this point

small ears (1)

reduces surface area / heat loss (1)
ignore keeps warm for this point

horns (1)

defence (1)

large shoulders (1)

to move through snow (1)

[4]

52 (a) digging /getting to insects

1

(b) catching insects / food / insects
stick to the tongue

1

(c) hear insects / predators

1

(d) stop soil / dust / insects getting in

1

[4]

53 (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]

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

- streamlined / smooth

  allow description eg long and thin ignore slimy / oily skin unless qualified

- flippers

  *allow fins **or** webbed feet*

- flattened / long / large / powerful tail

  tail must be qualified to gain credit

2

(b) **1** mark for each adaptation and **1** mark for its correct linked advantage

correct advantage mark can be awarded if adaptation is attempted but not awarded the mark

eg

fat / blubber (1)

ignore skin / fur

insulates (1)

allow keeps warm

or

large mass to area ratio **or** small area to mass ratio (1)

ignore large body unqualified

allow volume for mass

heat loss reduced (1)

ignore keeps warm

2

[4]

55 (a) protection / defence

*ignore insulation **or** rolls into a ball*

ignore camouflage

1

from predators / from being attacked / from being eaten

1

(b) looks like snake / looks scary

1

deters predators **or** has large eyes to spot predator **or** camouflage **or** warning colouration from predator or prey

*allow **two** separate adaptations for **2** marks*

1

(c) (i) natural selection

1

(ii) Darwin

1

(iii) simple life forms

1

(d) believe that God created all organisms **or** humans there from the beginning

1

[8]

56 (a) variation / mutation

1

individuals with characteristics most suited to environment survive

allow survival of the fittest

1

genes passed to next generation **or** these individuals reproduce

1

(b) any **two** from:

- similar in size to Emperor penguin **or** bigger than all penguins
- large size is adaptation to cold climate
- since less heat loss per unit of body volume **or** smaller surface area / volume ratio

2

[5]

57 (a) killed by poachers / killed for tusks

1

less trees / leaves to eat

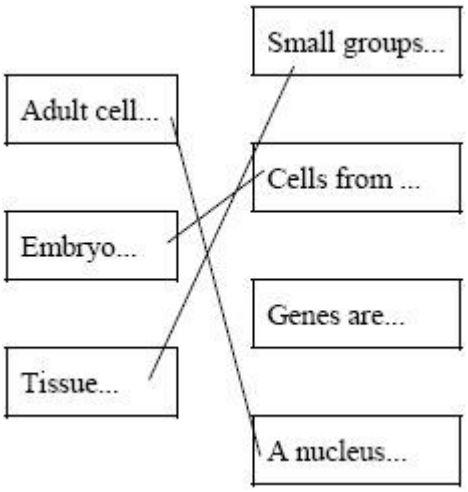
ignore feed on lots of leaves

1

land available disappearing

1

(b)



*all three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*
extra line from a statement cancels the mark

max 3

[6]