

Mark schemes

Q1.

(a) place the quadrat using random coordinates 1

(b)

$$\frac{40 + 52 + 88 + 80 + 40}{5}$$

or  $\frac{300}{5}$

1

60

1

(c) the area of buttercup plants in quadrat 5 is much larger 1

(d) any two from:

- place (many) more quadrats  
*allow repeat*  
*allow combine results with results of other students*
- divide quadrats into more / smaller squares
- estimate actual percentage cover in quadrat (instead of counting squares)
- only count squares with at least 50% cover  
*allow use a point quadrat*  
*ignore place quadrats randomly*

2

(e) any three from:

- light
- water  
*allow rain / moisture*
- minerals / ions / salts  
*allow named example such as nitrate / phosphate*  
*allow fertiliser*
- pH
- temperature
- herbivores  
*allow named example*
- trampling / cultivation

- pathogens / disease
  - use of weedkiller
- allow wind*  
*allow oxygen / air in the soil*  
*ignore carbon dioxide*  
*ignore weather*

3  
 [9]

Q2.

- (a) (put beaker in a) water bath  
*allow (put beaker in an) incubator*
- (b) volume of the milk  
 or  
 type of milk  
*allow amount of milk*  
*allow named type of milk, eg cows' or semi-skimmed*
- (c) correct scale and axis labelled  
*scale must be at least 1 cm for 1 day*
- all points plotted correctly  
*allow a tolerance of  $\pm \frac{1}{2}$  small square*  
*allow 4 or 5 correct plots for 1 mark*
- suitable curved line of best fit  
*ignore line joined point to point with straight lines*
- (d) similar shaped line drawn to left of 20 °C line on Figure 4
- same start pH  
*allow a tolerance of  $\pm \frac{1}{2}$  small square*  
*allow from student's line of best fit or student's plot for 0 days*

1  
 1  
 1  
 2  
 1  
 1  
 1  
 [8]

Q3.

Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4-6

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

1-3

No relevant content

0

Indicative content

*in microorganisms*

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

*in plants*

- carbon dioxide (from air) taken in by leaves
- by diffusion
- via stomata
- carbon dioxide used in photosynthesis
- making glucose / sugar / starch / cellulose or making other correctly named example
  
- (named) ions taken in by roots
- by active transport
- nitrate ions for making amino acids / proteins / DNA / chlorophyll
- phosphate for making DNA

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

[6]

Q4.

(a)

Factor	Biotic	Abiotic
Nitrates in the soil		✓
Rabbits eating the plants	✓	
Shading by a building		✓
Soil pH		✓
Temperature		✓
Trampling by people	✓	

all 6 correct = 3 marks

4 or 5 correct = 2 marks

	2 or 3 correct = 1 mark 0 or 1 correct = 0 marks	3
(b)	(grid and) coordinates	1
	to achieve randomness <i>ignore throwing quadrat</i> <i>allow random coordinates for 2 marks</i> <i>if no other mark awarded allow random walk or description of random walk for 1 mark</i>	1
(c)	(mean per m <sup>2</sup> =) 24 or $6 \times 4$	1
	(calculation of area of lawn =) $(\frac{1}{2} \times 16 \times 10) - (6 \times 3)$ or $80 - 18$	1
	(area of lawn =) 62 m <sup>2</sup> <i>allow correct calculation using total area (of triangle) - area of rectangle</i>	
	(total number of daisies =) 24 × 62 <i>allow correct calculation using an incorrectly calculated area of the lawn and / or mean</i>	1
	1488 <i>allow answer based on incorrect area</i>	1
	(answer to 3 sig figs =) 1490 <i>allow student's calculated answer rounded to 3 sig figs</i>	1
(d)	too few quadrats or quadrat too small <i>allow sample size too small</i>	1
	sample may not be representative of the lawn <i>allow quadrats may not have been placed randomly</i>	1
		[13]

Q5.

- (a) bacteria  
*allow singular* 1
- fungi  
*allow mould*  
*ignore microbes / germs / decomposers*  
*do not accept viruses* 1
- (b) fatty acid(s) 1
- (c) any one from:
- universal indicator (paper / solution)  
*allow UI (paper / solution)*  
*ignore pH paper unqualified*
  - pH meter  
*allow pH probe*  
*ignore datalogger unqualified*  
*ignore Cresol red*  
*ignore phenolphthalein / litmus* 1
- (d) any two from:
- volume of milk  
*allow amount of milk*
  - exposure to air / oxygen
  - sterilise test tubes  
*allow bungs on test tubes*
  - treatment of milk before investigation  
*allow example such as pasteurised or not*
  - freshness / age of milk (at start)
  - time of day pH was measured  
*allow starting pH of milk* 2
- (e) almond (milk) 1
- (f) as temperature increases up to 15 °C the time taken (to reach pH 5) decreases  
*allow converse* 1

above 15 °C the time taken (to reach pH 5) stays the same

*if no other mark awarded allow mark  
for as temperature increases the time  
taken (to reach 5  
°C) decreases and then stays the same*

1

(g) any one from:

- bacteria / microbes / microorganisms / fungi dividing faster  
(when warmer)  
*allow converse if clearly describing 5 °C  
allow number of bacteria / microbes /  
microorganisms / fungi increasing  
(when warmer)  
allow more bacteria microbes /  
microorganisms / fungi*
- reactions (in the bacteria) are happening faster (to decay milk)
- (because there is) more (kinetic) energy  
*allow particles move faster  
allow more collisions between particles*
- enzyme activity is higher (at 10 °C than at 5 °C)  
*allow enzymes work faster  
ignore enzymes work better*

1

(h) any two from:

- different concentration / type of fat / lipid  
*allow different amounts of fat / lipid*
- different concentration / type of proteins / carbohydrate / sugar  
*allow different amounts of proteins /  
carbohydrate / sugar*
- different (amount / type of) bacteria present
- may have been pasteurised by a different process  
*allow may have been treated in different  
ways (before the investigation)*
- different starting pH  
*ignore different oxygen concentration*

2

(i) determine the types of bacteria present in the milk

1

[13]

Q6.

- (a) bacteria 1
- fungi 1
- (b) both increase rate 1
- because oxygen is needed for (aerobic) respiration or oxygen is used to release energy  
*do not accept anaerobic*  
*ignore energy produced* 1
- as increased temperature causes faster reactions  
*allow named example*  
*eg respiration*  
*allow increased rate of enzyme action* 1
- (c) water  
*allow H<sub>2</sub>O / H<sub>2</sub>O / moisture / rain*  
*do not accept H<sub>2</sub>O / H<sub>2</sub>O* 1
- (d) methane 1
- (e) 60  
*allow sixty* 1
- (f) so plants / crops grow faster / better 1
- (decays further and) releases / contains mineral ions / named example  
*allow releases / contains nutrients*  
*ignore nitrogen / food / carbon dioxide*  
*allow as a fertiliser*  
*allow retains water in soil*  
*allow improves drainage*  
*allow insulates / keeps warm*  
*allow suppresses weed growth*  
*allow improves soil structure* 1
- [10]

Q7.

- (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  
*reference to more is only needed once*  
*for the first two marking points* 1
- (g) fertilisation  
*ignore sexual reproduction* 1
- (h) asexual (reproduction)  
*allow cloning* 1
- [10]

Q8.

- (a) description of a method to achieve random placement  
*examples could include random number generator or random coordinates*  
*allow throw over the shoulder or with eyes shut*  
*ignore throw unqualified* 1
- (b) any one from:
- random (location)  
*allow by chance*
  - avoid bias
  - obtain valid / representative results  
*allow more accurate / precise mean*



- ignore fair test / accurate / precise  
unqualified* 1
- (c) as a control / comparison  
*allow see the difference* 1
- or  
B varies from A in only one factor  
*do not accept a control variable*  
(to) show results (in A) are due to weed killer  
*allow to see the effect of the weed killer  
allow so the results are valid* 1
- (d) 11  
*allow eleven* 1
- (e)  $\frac{10-2}{10} \times 100$   
80  
*an answer of 80 scores 2 marks* 1
- (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]

Q9.

- (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<sup>2</sup> ⇒) 6 or 6.0 1
- (correct field area ⇒) 55 000 (m<sup>2</sup>) 1
- mean × area – e.g. 6(.0) × 55 000  
*allow incorrect calculated values for*  
*mean and / or field area* 1
- 330 000  
*allow correct calculation from previous*  
*calculation* 1
- $3.3 \times 10^5$   
*allow calculated value in standard form* 1  
*an answer of  $3.3 \times 10^5$  scores 5 marks*  
*an answer of 330 000 scores 4 marks*
- (c) Level 3: The method would lead to the production of a valid outcome.  
 All key steps are identified and logically sequenced. 5–6
- Level 2: The method would not necessarily lead to a valid outcome.  
 Most steps are identified, but the method is not fully logically  
 sequenced. 3–4
- Level 1: The method would not lead to a valid outcome. Some  
 relevant steps are identified, but links are not made clear. 1–2
- No relevant content 0
- Indicative content
- placing of quadrat
  - large number of quadrats used
  - how randomness achieved – e.g. table of random numbers or  
 random number button on calculator or along transect

- quadrats placed at coordinates or regular intervals along
- transect
- in each of two areas of different light intensities or transect
- running through areas of different light intensity
- for each quadrat count number of dandelions
- for each quadrat measure light intensity
- compare data from different light intensity

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

(d) any two from:

- temperature  
*allow heat*
- water  
*allow moisture / rain*
- (soil) pH  
*allow acidity*
- minerals / ions  
*allow e.g. magnesium ions or nitrate*  
*allow salts / nutrients*
- winds
- herbivores  
*allow trampling*  
*ignore carbon dioxide*  
*ignore space*  
*ignore competition unqualified*  
*do not accept oxygen*

2

[14]

Q10.

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

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

1

- (b) heating

1

to over 100°C

*allow place in oven / pressure cooker*  
*do not accept disinfectant*

*allow other suitable method – e.g. use of UV*

1

- (c) to prevent microorganisms entering from the air

*allow bacteria / fungi / microbes for microorganisms*

*do not accept viruses*

*ignore germs*

1

- (d)

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

*all correct for 1 mark*

1

- (e) (pH meter) – more accurate / more precise

*allow more exact*

*allow can measure to 0.1 pH unit*

*or to smaller intervals of pH*

1

(leaving...6 days) – obtain greater pH change

or

because there was (very) little change in 3 days

*allow more acid will be made*

1

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

1

points plotted correctly

*all 7 correct = 2 marks*

*5 or 6 correct = 1 mark*

2

line of best fit = smooth curve through points

*do not accept ruled point-to-point*

1

- (g) (1st day) too few bacteria

1

(after day 1 more bacteria so more) acid made

1

(days 5-6) sugar / food used up

or  
low pH denatures enzymes

or  
low pH kills bacteria *allow enzymes do not work*  
*do not accept enzymes killed*

1

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

1

(difference) – faster

1

[16]

### Q11.

- (a) any two from:

- sprinkled through air
- air spaces between stones
- thin layer over stones (for efficient diffusion)
- slow flow (for efficient diffusion)

2

- (b) green algae

1

- (c) (large / small) protist

1

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

Level 1 (1-2 marks):

Facts, events or processes are identified and simply stated but their relevance is not clear.

No relevant content (0 marks)

Indicative content

digestion:

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

absorption:

- by diffusion / active transport

deamination:

- amino acids → ammonia / ammonium ions

release of other ions:

- e.g. phosphate / nitrate / magnesium

respiration:

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

[8]

Q12.

- (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)  $(11\ 000 \times 0.1 =)$   
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]

Q13.

- (a) measure the length / area of the field

- 1
- (b) use (a) random number(s) (generator)  
or  
use coordinates method explained 1
- (c) compare their results with another student's results 1
- place more quadrats 1
- (d)  $0.25 \times 5 = 1.25$  1
- $500 / 1.25 = 400$  1
- $(40 \times 400 =) 16\ 000$   
*allow 16 000 with no working shown for 3 marks* 1
- (e) 11 1
- (f) (quadrat) 5 1  
*both quadrat number and correct reason must be given for 1 mark*
- very few or only 2 growing (here)

[9]

Q14.

- (a) methane is produced 1  
*ignore bad smell*
- which is a greenhouse gas / causes global warming 1
- (b)  $(9.80 / 0.20 = 49 \text{ therefore}) 49:1$  1
- (c) horse (manure) 1  
*allow ecf from 11.2*
- closest to 25:1 (ratio)
- (d) Level 3 (5–6 marks):  
A detailed and coherent explanation is given, which logically links how carbon is released from dead leaves and how carbon is taken up by a plant then used in growth.

Level 2 (3–4 marks):

A description of how carbon is released from dead leaves and how carbon is taken up by a plant, with attempts at relevant explanation, but linking is not clear.

Level 1 (1–2 marks):

Simple statements are made, but no attempt to link to explanations.

0 marks:

No relevant content.

Indicative content

statements:

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

explanations:

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

use of carbon in growth:

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

6

(e) any three from:

(storage conditions)

- (at) higher temperature / hotter
  - (had) more oxygen
  - (had) more water / moisture
  - (contained) more microorganisms (that cause decay)
- allow reference to bacteria / fungi / mould*

3

[13]

Q15.

(a) any one from:

- continuous readings
- do not need to be there
- *allow automatic readings*  
(more likely to be) accurate
- *allow greater resolution*  
*do not allow valid*
- reduces human error
- *allow easier to read*

1



- (b) (i) microorganisms  
*allow microbes / bacteria / fungi / decomposers for microorganisms, throughout* 1
- (microorganisms) respire 1
- respiration / decay / microorganisms releases carbon dioxide  
*ignore carbon released* 1
- (ii) all grass decomposed / decayed / rotted  
*allow idea that all microorganisms dead (due to accumulation of waste or lack of oxygen)*  
*allow lack of / no oxygen (for respiration of microorganisms)* 1
- [5]

Q16.

- (a) 88 000  
*correct answer = 2 marks*  
*allow 1 mark for 1.1 (in 1 m<sup>2</sup>)*  
*or*  
*allow 1 mark for answer = [candidate's value in 1m<sup>2</sup>] × 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]