AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.3.3

Land use

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**64**
Available paper years	**2007–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.7.3.3 Land use

Answer 01 · Mark scheme March 2007 | BLY1A | Original Q8 | Legacy

Eight	**4**	**1**	**2**	**4**

Answer 02 · Mark scheme June 2007 | BLY1B | Original Q7 | Legacy

Seven	**2**	**1**	**4**	**2**

Answer 03 · Mark scheme March 2008 | BLY1BP | Original Q5 | Legacy

Five	**1**	**3**	**4**	**1**

Answer 04 · Mark scheme June 2008 | BLY1BP | Original Q1 | Legacy

One	**A**	nucleus transferred from skin cell of Dog Y	**2**
	B	electric shock applied	**3**
	C	ball of cells inserted into womb of female	**4**
	D	nucleus removed	**1**

Answer 05 · Mark scheme November 2008 | BLY1BP | Original Q5 | Legacy

Five	**3**	**2**	**3**	**3**

Answer 06 · Mark scheme March 2009 | BLY1BP | Original Q6 | Legacy

Six	**2**	**4**	**1**	**3**

Answer 07 · Mark scheme June 2009 | BLY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**1**	*

* This question has been removed

4.7.3.3 Land use

Answer 08 · Mark scheme

June 2009 | BLY2H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	B		1
4(a)(ii)	any **one** from: • largest area of / most digestion (of lipid) • largest clear area	allow agar / jelly / mixture broken down / digested do **not** allow digestion of bacteria / lipase ignore digestion **by** bacteria	1
4(b)	any **two** from: • effect of pH / pH described • effect of temperature • effect on different types of lipid / fat • cost **or** allergic reactions **or** effect on skin / fabrics / **or** environment **or** interaction with other chemicals in powder **or** shelf life		2
4(c)	enzymes / named enzyme denatured / destroyed	allow active site(of enzyme) altered	1
Total			**5**

4.7.3.3 Land use

Answer 08 · Mark scheme

June 2009 | BLY2H | Original Q4 | Legacy

BLY2H

4.7.3.3 Land use

Answer 09 · Mark scheme

June 2009 | BLY2H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	(wholemeal bread) any **two** from: lower maximum / peak / less change slower rise / change need to take less insulin / less likely to hyper	no mark for identifying the type of bread but max **1** mark if not identified ignore references to rate of fall **or** first to peak	 1 1
5(a)(ii)	any **four** from: • amylase / carbohydrase • starch to sugar • (sugar) absorbed / diffused / passes into blood • correct reference to pancreas • insulin produced • glucose (from blood) into cells / tissue / organ **or** named tissue / organ • glucose used in respiration / for energy	max 3 for explaining rise max 3 for explaining fall allow starch to glucose allow once only as rise or fall allow glucose to glycogen	4

Question 5 continues on the next page…

BLY2H

Question 5 Continued

question	answers	extra information	mark
5(b)	any **three** from: advantages (compared to insulin injections): • (may be) permanent / cure • no / less need for self monitoring • no / less need for insulin / injections • no / less need for dietary control disadvantages (compared to insulin injections): • low success rate • (may) still need insulin / dietary control • operation hazards • risk of infection from donor • rejection / need for drugs to prevent rejection	max **2** if only advantages **or** only disadvantages discussed can give converse if clear that it relates to insulin injections ignore reference to cost	3
Total			**9**

4.7.3.3 Land use

Answer 09 · Mark scheme June 2009 | BLY2H | Original Q5 | Legacy

BLY2H

Answer 10 · Mark scheme November 2009 | BLY1BP | Original Q5 | Legacy

Five	**3**	**1**	**4**	**1**

Answer 11 · Mark scheme November 2009 | BLY1BP | Original Q7 | Legacy

Seven	**2**	**3**	**3**	**4**

4.7.3.3 Land use

Answer 12 · Mark scheme

January 2010 | BLY2H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	oxygen produced		1
4(a)(ii)	any **one** from: • average / mean / median • some may be anomalous	ignore reliable / precise / accurate allow some may not float	1
4(b)(i)	any **two** from: • low intensity / below 12.5 / 2.5 – 12.5 *(*units of light*)* flat wrack / it, rate of photosynthesis faster **or** saw wrack rate of photosynthesis slower • high intensity / above 12.5 / 12.5 – 15 (units of light) flat wrack / it, rate of photosynthesis slower **or** saw wrack rate of photosynthesis faster • same (rate) at 12.5 units	do **not** allow answers in terms of time only if candidate answers in terms of comparing rate of change then the rate of change of photosynthesis must be in the correct direction for **1** mark allow any value in range allow any value in range	2

Question 4 continues on the next page

BLY2H

Question 4 continued

question	answers	extra information	mark
4(b)(ii)	any **two** from: • saw wrack receives less light • less photosynthesis **or** less carbohydrate / sugar / starch production • when tide is in **or** at high tide **or** any tide above low tide	 accept converse if clear reference to bladder wrack if first and second responses, 'less' needed only once accept saw wrack covered by water / submerged longer / more reference to position on shore is insufficient	2
Total			**6**

4.7.3.3 Land use

Answer 12 · Mark scheme

BLY2H

4.7.3.3 Land use

Answer 13 · Mark scheme

January 2019 | BLY3H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	to mix in oxygen / air **or** to allow aerobic respiration / prevent anaerobic	allow stops olive oil separating out	1
7(a)(ii)	so *Fusarium* not limiting **or** so can see effect of protein / oil (concentration)		1
7(b)(i)	300	correct answer with or without working = **2** marks $\frac{(8000-800)}{24}$ **or** $\frac{7200}{24}$ if one error only eg **or** $\frac{8000-1000}{24}$ allow **1** mark	2
7(b)(ii)	cannot tell how accurate / precise / reliable the values are **or** there may be a wide range results may overlap with values for other conditions **or** may not be significantly different from other conditions	do **not** allow – to make it more accurate / precise / reliable allow suitable reference to anomalies	1 1

Question 7 continues on the next page...

BLY3H

Question 7 continued

question	answers	extra information	mark
7(c)(i)	<u>description</u>:	each point made must compare *Fusarium* growth **and** lipase production	
	Fusarium grows (mainly) before lipase production starts	allow correct use of figures	1
	as *Fusarium* growth slows lipase production speeds up		1
7(c)(ii)	<u>explanation</u>: any **two** from: • need sufficient growth of *Fusarium* before it can release / make / produces (detectable) lipase • initial *Fusarium* growth uses protein (from reaction mixture) **or** protein more important than lipid for *Fusarium* growth • later *Fusarium* growth uses lipid / oil (from reaction mixture)	allow no lipase production until 'nutrients' used up / limiting	2
Total			**10**

4.7.3.3 Land use

Answer 14 · Mark scheme

March 2010 | BLY1AP | Original Q9 | Legacy

Nine	**2**	**4**	**4**	**2**

Answer 15 · Mark scheme

March 2010 | BLY1BP | Original Q8 | Legacy

Eight	**2**	**4**	**2**	**3**

Answer 16 · Mark scheme

June 2010 | BLY1BP | Original Q4 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 17 · Mark scheme

June 2010 | BLY1BP | Original Q8 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.7.3.3 Land use

Answer 18 · Mark scheme

June 2010 | BLY3H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	to kill (micro)organisms / bacteria / microbes **or** to sterilise	allow get rid of organisms etc allow kill germs	1
2(a)(ii)	(micro)organisms / they could not enter (the broth / flask) **or** (micro)organisms / they get trapped / stuck (in the bend)	apply list principle to air	1
2(b)	(more) reliable **or** to check if anomalous / consistent (same every time)	do **not** allow precise / accurate / valid / fair	1
2(c)	any **two** from: • microorganisms now enter (the broth / flask) • microorganisms from air / bend / neck / x • food / nutrients / energy source for microorganisms (in broth)	ignore oxygen / air	2
2(d)	biogenesis		1
Total			**6**

4.7.3.3 Land use

Answer 18 · Mark scheme June 2010 | BLY3H | Original Q2 | Legacy

BLY 3H

Answer 19 · Mark scheme November 2010 | BLY1AP | Original Q3 | Legacy

Three	**3**	**2**	**4**	**1**

Answer 20 · Mark scheme November 2010 | BLY1BP | Original Q5 | Legacy

Five	**2**	**3**	**4**	**1**

4.7.3.3 Land use

Answer 21 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	colour of light / bulb / lamp	allow wavelength for colour allow bulb alone do **not** accept light / colour unqualified	1
1(a)(ii)	any **one** from eg • temperature • light intensity **or** distance between lamp and plant / tube • carbon dioxide • other light in room • mass / size / amount / age / type of pondweed • volume / amount of water	 allow heat allow amount / brightness of light ignore light unqualified allow symbols allow use a dark room allow same piece of pondweed ignore pondweed unqualified ignore reference to time	1
1(a)(iii)	improved reliability **or** can spot anomalies / changes	allow for reliability **or** less likely to lose count allow reference to calculating a mean / average ignore reference to accuracy / precision / fair	1
1(b)(i)	green		1

Question 1 continues on the next page

BLY2H

Question 1 continued

question	answers	extra information	mark
1(b)(ii)	any **two** from: • least / less bubbles / gas / oxygen / mean • least / less photosynthesis • least / less glucose / sugar / carbohydrate / food made	ignore references to colour reference to least / less needed only once, in context, for **2** marks only penalise no once, ie no bubbles = **0** mark no bubbles so no photosynthesis = **1** mark allow most / more green light reflected (by chloroplasts)	2
Total			**6**

4.7.3.3 Land use

Answer 21 · Mark scheme

January 2011 | BLY2H | Original Q1 | Legacy

BLY2H

4.7.3.3 Land use

Answer 22 · Mark scheme

January 2011 | BLY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	maintain / constant / suitable / optimum temperature **or** to prevent overheating	ignore to cool (= question)	1
	high temperature denatures enzymes / proteins / high temperature kills microorganisms / fungus	do **not** allow death of enzymes / denatures microorganisms	1
	microorganisms / fungus / respiration release energy	allow release heat	1
6(b)	any **four** from: • very little / no measurable fungus / biomass before 20 h • need fungus present to make protease enzyme **or** protease is a product from the fungus **or** protease not made until the fungus is made • protease not made until glucose is used • glucose needed for energy / respiration **or** glucose as material for growth / to make more fungus • equipment not sensitive enough to measure low concentrations	allow spores take about 20 h to start growth allow protease increases as glucose decreases	4

Question 6 continues on the next page

BLY3H

Question 6 continued

question	answers	extra information	mark
6(c)	40 (no mark) any **two** from: • (40) gives the highest yield / activity of enzyme per g glucose • (40) gives highest yield / activity of enzyme per g fungus produced. • (40) is more economic / saves money	if neither point made allow **1** mark for (40) gives the highest yield / activity of enzyme	2
Total			**9**

4.7.3.3 Land use

Answer 22 · Mark scheme January 2011 | BLY3H | Original Q6 | Legacy

BLY3H

Answer 23 · Mark scheme March 2011 | BLY1BP | Original Q3 | Legacy

Three	**2**	**2**	**3**	**2**

Answer 24 · Mark scheme March 2011 | BLY1BP | Original Q7 | Legacy

Seven	**3**	**4**	**2**	**2**

Answer 25 · Mark scheme March 2011 | BLY1BP | Original Q9 | Legacy

Nine	**1**	**1**	**3**	**3**

Answer 26 · Mark scheme June 2011 | BLY1AP | Original Q6 | Legacy

Six	**2**	**3**	**1**	**4**

Answer 27 · Mark scheme

June 2011 | BLY2H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	any **one** from: • (same) volume / amount / 1 cm^3 lipase • (same) volume / amount / 5 cm^3 lipid • mixed after 3 minutes / same time before mixing	ignore reference to recording results every 5 minutes **or** concentrations of lipid / lipase allow amount of solution allow keep same volumes in the test tubes do **not** accept temperature	1
3(b)	so that the lipase and the lipid reached the right temperature		1
3(c)	any **two** from • decrease in time **or** faster (breakdown) • then increase in time **or** then slower (breakdown) • fastest / least time / optimum at 35°C	ignore explanations	2
3(d)	any **two** from: • test more regularly eg test every minute • test at smaller temperature intervals • test between 50 (^{o}C) and 95 (^{o}C) • repeat at same temperatures **or** repeat the investigation **or** compare results with others	ignore 'test at more temperatures' unqualified any interval < 5min any value <15°C allow test more temperatures in the range any value in range, eg test at 70 allow do **it** again	2

Question 3 continues on the next page

4.7.3.3 Land use

Answer 27 · Mark scheme

June 2011 | BLY2H | Original Q3 | Legacy

Question 3 continued

question	answers	extra information	mark
3(e)(i)	(lipase / it) denatured / destroyed / changed shape	allow damaged / deformed do **not** accept killed ignore broken (down)	1
3(e)(ii)	fatty acids and glycerol		1
Total			**8**

BLY2H

Answer 28 · Mark scheme

November 2011 | BLY1BP | Original Q8 | Legacy

Eight	**1**	**1**	**1**	**2**

4.7.3.3 Land use

Answer 29 · Mark scheme

Question 1

question	Answers	extra information	mark
1(a)	any **one** from: • add a water bath • heat screen • use LED • low energy bulb / described	ignore 'check temperature'	1
1(b)(i)	rate / number of bubbles decreases **or** less oxygen / gas released	accept converse with reference to increasing light **or** shorter distance ignore reference to rate of photosynthesis	1
1(b)(ii)	temperature / CO_2 (concentration)	accept 'it was too cool' **or** not enough CO_2 accept number of chloroplasts / amount of chlorophyll allow heat allow CO2 do **not** allow CO^2	1

Question 1 continues on the next page . . .

BL2HP

Question 1 continued . . .

<table>
<tr><th>question</th><th>Answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>1(c)</td><td colspan="2">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 on page 5, and apply a ‘best-fit’ approach to the marking.</td><td colspan="2">6</td></tr>
<tr><td></td><td>0 marks</td><td>Level 1 (1-2 marks)</td><td>Level 2 (3-4 marks)</td><td>Level 3 (5-6 marks)</td></tr>
<tr><td></td><td>No relevant content.</td><td>There is a brief description of at least 1 tissue or at least 1 function of an indicated part of the leaf.
The account lacks clarity or detail.</td><td>There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.</td><td>There is a detailed description of most of the structures and their functions.</td></tr>
<tr><td></td><td colspan="4">examples of responses:
• epidermis
• cover the plant
• mesophyll / palisade
• photosynthesises
• phloem
• xylem
• transport.
The following points are all acceptable but beyond the scope of the specification:
• (waxy) cuticle – reduce water loss
• epidermis – no chloroplasts so allows light to penetrate
• stomata / guard cells – allow CO_2 in (and O_2 out) or controls water loss
• palisade (mesophyll) – <u>many</u> chloroplasts to trap light
– near top of leaf for receiving more light
• spongy (mesophyll) – air spaces for rapid movement of gases</td></tr>
<tr><td>Total</td><td colspan="2"></td><td></td><td>9</td></tr>
</table>

4.7.3.3 Land use

Answer 29 · Mark scheme

January 2013 | BL2HP | Original Q1 | Legacy

BL2HP

4.7.3.3 Land use

Answer 30 · Mark scheme

June 2013 | BL2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	A = cytoplasm B = (cell) membrane		1 1
4(b)	in yeast: makes alcohol / makes CO_2 / does not make lactic acid	'it' equals yeast do not allow uses / involves alcohol / CO_2	 1
4(c)(i)	any **two** from: • volume of yeast / suspension • volume of sugar / solution • concentration of sugar • temperature	 allow amount of yeast amount of sugar = max 1 for sugar (total) volume = 1 mark if no other volume ignore concentration of yeast	2
4(c)(ii)	most / more CO_2 given off with fructose **or** faster CO_2 production **or** faster respiration so (rate of) alcohol production will be greatest / more (with fructose)	'it' equals fructose allow faster fermentation do **not** allow aerobic respiration	1 1
Total			**7**

4.7.3.3 Land use

Answer 31 · Mark scheme

June 2013 | BL2HP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	DNA replication / copies of genetic material were made	'it' = a chromosome allow chromosomes replicate / duplicate / are copied ignore chromosomes divide / split / double	1
8(a)(ii)	one copy of each (chromosome / chromatid / strand) to each offspring cell each offspring cell receives a complete set of / the same genetic material	ignore ref. to gametes and fertilisation allow 'so offspring (cells) are identical'	1 1
8(b)(i)	meiosis	allow mieosis as the only alternative spelling	1
8(b)(ii)	Species A = 4 **and** Species B = 8		1
8(b)(iii)	sum of A + B from (b)(ii) e.g. 12		1

Question 8 continues on the next page...

Question 8 continued...

question	answers	extra information	mark
8(c)(i)	similarities between chromosomes **or** similarities between flowers described	 e.g. shape of petals / pattern on petals / colour / stamens	1
	can breed / can sexually reproduce	allow can reproduce with each other / they can produce offspring	1
8(c)(ii)	any **two** from: • offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes • some chromosomes unable to pair (in meiosis) • (viable) gametes not formed / some gametes with extra / too many genes / chromosomes **or** some gametes with missing genes / chromosomes		2
Total			**10**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.7.3.3 Land use

Answer 32 · Mark scheme June 2014 | BL2HP | Original Q3 | Legacy

3(a)	anaerobic respiration	allow phonetic spelling	1	AO1 2.6.2a, b,d
3(b)(i)	4.4	4.2, 4.3, 4.5 or 4.6 with figures in tolerance (6.7 to 6.9 and 2.3 to 2.5) and correct working gains 2 marks 4.2, 4.3, 4.5 or 4.6 with no working shown or correct working with one reading out of tolerance gains 1 mark correct readings from graph in the ranges of 6.7 to 6.9 **and** 2.3 to 2.5 but no answer / wrong answer gains 1 mark	2	AO2 2.6.2a, b,d
3(b)(ii)	more energy is needed / used / released (at 14 km per hour) not enough oxygen (can be taken in / can be supplied to muscles) so more anaerobic respiration (to supply the extra energy) **or** more glucose changed to lactic acid	do **not** allow energy production ignore work allow reference to oxygen debt do **not** allow less / no oxygen allow not enough aerobic respiration	1 1 1	AO1 / AO2 2.6.2a, b,d
Total			**6**	

4.7.3.3 Land use

Answer 32 · Mark scheme

June 2014 | BL2HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.7.3.3 Land use

Answer 33 · Mark scheme

June 2014 | BL2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.
5(a)(i)	to get data re position of seaweed / of organism in relation to distance from sea / distance down shore / how long each seaweed was exposed		1 1	AO2 2.4.1b
5(a)(ii)	repeat several times elsewhere along the shore	minimum = 2 repeats	1 1	AO3 2.4
5(a)(iii)	bladder wrack is further up the shore (than the sea lettuce) / exposed for longer sea lettuce (only) in rock pools / in the sea / (only) in water	ignore found in dry areas / on bare rock	1 1	AO3 2.4.1a,b
5(b)	gets more light / closer to light (so) more photosynthesis	allow better access to CO_2 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 1	AO1 / AO2 2.4.1a, 2.3.1c
Total			8	

4.7.3.3 Land use

Answer 33 · Mark scheme

June 2014 | BL2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.7.3.3 Land use

Answer 34 · Mark scheme

June 2014 | BL3HP | Original Q2 | Legacy

2			6	AO1 3.3.1

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 on page 5 and apply a 'best-fit' approach to the marking.

0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**
No relevant content	There is at least one reason for deforestation **or** an attempt at a description of at least one way deforestation is affecting the atmosphere.	There is at least one reason for deforestation **and** a description of the way deforestation is affecting one gas in the atmosphere **or** the process that causes an effect.	There are reasons for deforestation **and** a clear description of the way deforestation is affecting one gas in the atmosphere **and** the process that causes this.

examples of the points made in the response	**extra information**
Reasons for deforestation • timber for construction / furniture / boat building / paper production • growing plants for biofuels for motor fuel / aviation / lawnmowers • use of wood as a fuel • land for building or agriculture to provide food, such as rice fields and cattle ranching	

Effects of deforestation
• increase in carbon dioxide in atmosphere
  ○ due to burning
  ○ due to activities of microbes
  ○ less carbon dioxide taken in / locked up (by trees)
  ○ less photosynthesis
• increase in methane in atmosphere due to rice production / cattle
	ignore references to oxygen
	
	accept explanations of the effect of water (vapour)

4.7.3.3 Land use

Answer 34 · Mark scheme

June 2014 | BL3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.7.3.3 Land use

Answer 35 · Mark scheme

June 2014 | BL3HP | Original Q5 | Legacy

5(a)(i)	guard (cells)	allow phonetic spelling	1	AO1 3.1.3e
5(a)(ii)	any **one** from: • allow carbon dioxide to enter • allow oxygen to leave.	ignore reference to cells allow control loss / evaporation of water **or** control transpiration rate allow 'gaseous exchange'	1	AO1 3.1.3a, c,e
5(b)(i)	200	correct answer gains 2 marks with or without working allow 1 mark for 0.1 × 0.1 = 0.01 (mm^2)	2	AO2 3.1.3
5(b)(ii)	more / a lot of / increased water loss	allow plant more likely to wilt (in hot / dry conditions)	1	AO3 3.1.3d
5(c)(i)	0.12		1	AO2 3.1.3
5(c)(ii)	the lower surface has most stomata stomata are now covered / blocked (by grease) so water cannot escape / evaporate from the stomata	 ignore waterproof to gain credit stomata must be mentioned at least once	1 1 1	AO3 3.1.3c, d
Total			9	

4.7.3.3 Land use

Answer 35 · Mark scheme

June 2014 | BL3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.7.3.3 Land use

Answer 36 · Mark scheme June 2014 | BL3HP | Original Q7 | Legacy

7(a)(i)	(initially there is) oxygen (so) aerobic respiration (by microorganisms) producing CO_2 (which does not burn)	accept: oxygen hasn't been used up yet (so not anaerobic conditions yet) (because) methane is produced in anaerobic (fermentation) there is no methane ignore inflammable	1 1 1	AO1 / AO2 3.4.3c
7(a)(ii)	(peelings had) the most carbohydrate / organic material	answer must be comparative accept contained more microorganisms / decomposers / bacteria ignore water do **not** allow fat or protein	1	AO3 3.4.3c
7(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	AO2 3.4.3c
7(b)(ii)	(sheep manure) produces a higher volume of biogas / almost double **or** produces 0.27 (m^3 per kg) more (sheep manure) produces biogas with a higher percentage methane **or** produces 2% more methane	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 allow correct difference in volume calculated using 0.408(7) / 0.41 / 0.409 minus answer given in 7(b)(i) for 2 marks	1 1	AO2 3.4.3c
Total			8	

4.7.3.3 Land use

Answer 37 · Mark scheme

June 2015 | BL2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	glycerol		1	AO1 2.5.2f
1(a)(ii)	pancreas / small intestine	accept duodenum / ileum ignore intestine unqualified	1	AO1 2.5.2f
1(b)	any **two** from: • type of milk • volume / amount of milk • vol. bile equals vol. water • volume of lipase • concentration of lipase • temperature	ignore time interval ignore solution unqualified do **not** allow pH ignore starting pH ignore volume / amount of bile / water ignore concentration of bile accept amount of lipase if neither volume nor concentration given	2	AO3 2.5.2f,h
1(c)(i)	fatty acid (production)		1	AO2 2.5.2f,h
1(c)(ii)	faster reaction / digestion (with bile) **or** pH decreases faster (with bile) **or** takes less time (with bile) **or** steeper fall / line (with bile)	allow use of data ignore easier	1	AO3 2.5.2f,h

4.7.3.3 Land use

Answer 37 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(c)(iii)	all fat / milk digested **or** same amount of fatty acids present **or** (lower pH) denatures the enzyme / lipase	allow all reactants used up ignore reference to neutralisation allow enzyme won't work at low pH do **not** allow enzyme killed	1	AO2 2.5.2f,h
Total			**7**	

4.7.3.3 Land use

Answer 37 · Mark scheme

June 2015 | BL2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref

4.7.3.3 Land use

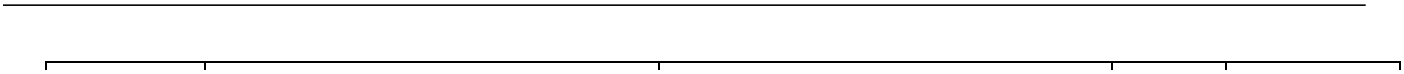
Answer 38 · Mark scheme June 2015 | BL3HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	any **two** from: • (volume of) peat compost has been steady and then declined **or** volume of peat compost has declined since 2005 • (volume of) peat-free compost has increased (since 1999) • (volume of) peat is higher than peat-free until 2005, then peat-free compost is higher (than peat) • total volume of peat and peat-free compost has increased	allow 2007 instead of 2005 allow 2007	2	AO2 342d
3(b)	increases carbon dioxide (in the atmosphere)	ignore methane	1	AO1 342
3(c)	any **one** from: • reduces biodiversity • destruction of habitats • disruption of food chains		1	AO1 342b
Total			**4**	

4.7.3.3 Land use

Answer 38 · Mark scheme

June 2015 | BL3HP | Original Q3 | Legacy



4.7.3.3 Land use

Answer 39 · Mark scheme

June 2015 | BL3HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	(rapid) growth in population (size) increase in the standard of living	 accept description of increased standard of living, eg more packaging, more food thrown away or overbuying resources	1 1	AO1 341a
4(b)(i)	41.5	allow 1 mark for 9733 ÷ 23454 **or** allow 1 mark for 0.415 **or** allow 1 mark for 41.49 **or** 41 **or** 41.4	2	AO2 341
4(b)(ii)	any **four** from: arguments for: • there has been a reduction in total waste • there has been an increase in (total mass of) recycling • there has been an increase in the percentage of waste recycled • it (may) not be possible to achieve zero waste arguments against: • there is still a lot of waste (not recycled) • there has only been a small reduction in total waste • there was one year (2006) where total waste went up • the rate of increase of percentage recycled is slowing down • no information on materials reused • no information on waste from factories / industry	max 3 marks for a one sided argument allow as reason against if clear allow still more than half or 56.8% of waste (not recycled)	4	AO3 341

4.7.3.3 Land use

Answer 39 · Mark scheme

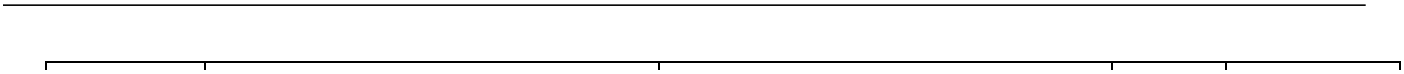
June 2015 | BL3HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(c)(i)	any **two** from: • reduce biodiversity **or** extinction • change in migration patterns • change in species distribution • change in climate	ignore rise in sea levels ignore temperature change accept correct examples of climate change eg storms, flooding, drought references to weather changing is insufficient allow ice caps melting or habitat destruction	2	AO1 343a
4(c)(ii)	any **one** from: • absorbed by oceans / ponds / lakes • peat bogs	allow used for skeletons / shells of sea creatures allow in fossil fuels / limestone	1	AO1 343b
Total			**11**	

4.7.3.3 Land use

Answer 39 · Mark scheme

June 2015 | BL3HP | Original Q4 | Legacy



4.7.3.3 Land use

Answer 40 · Mark scheme

June 2015 | BL3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	has the least amount of glucose (to) transfer energy (for the run)	allow least amount of fat **or** no fat allow (to) release energy (for the run) do **not** allow produces energy do **not** allow 'energy for respiration'	1 1	AO2 311d/e
5(a)(ii)	any **one** from: • cells will work inefficiently • absorb too much water / swell / overhydrate • lose too much water / shrink / dehydrate	ignore turgid / flaccid cells burst is insufficient allow cramp in muscle	1	AO2 311c/f
5(b)	any **three** from: • thermoregulatory centre • (has temperature) receptors • (which) monitor blood temperature (as it flows through the brain) • (temperature) receptors in the skin • (receptors) send impulses to the brain	ignore vasoconstriction / vasodilation / sweating allow hypothalamus impulses sent to the thermoregulatory centre = 2 marks	3	AO1 332b/c

4.7.3.3 Land use

Answer 40 · Mark scheme

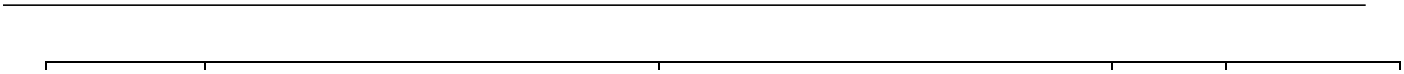
June 2015 | BL3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(c)(i)	(sports drinks) contain a lot of glucose (a person with diabetes) does not produce insulin **or** does not produce enough insulin so <u>blood</u> glucose / sugar levels will rise too high **or** to a dangerous level	 allow (person with diabetes) has cells which do not respond to insulin do **not** allow insulin produced by liver	1 1 1	AO1 / AO2 333c
5(c)(ii)	inject insulin **or** have an insulin pump (fitted)	do **not** allow swallow insulin accept exercise accept inhale insulin accept take metformin **or** other correctly named drug allow pancreatic transplant	1	AO1 333d
Total			**10**	

4.7.3.3 Land use

Answer 40 · Mark scheme

June 2015 | BL3HP | Original Q5 | Legacy



4.7.3.3 Land use

Answer 41 · Mark scheme

June 2017 | BL2HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	sugar(s) / glucose	allow maltose do not allow if extra incorrect answers	1	AO1 2.5.2d Prac
3(b)(i)	any **two** from: • volume of pH solution • volume of amylase / enzyme solution • volume of starch / suspension / substrate • time left (before mixing)	allow amount for volume if neither mark given allow 1 mark for volume(s) of solution(s) ignore time between samples ignore ref. to (room) temperature ignore ref. to concentration	2	AO2 2.5.2b Prac
3(b)(ii)	4 minutes: (dark) blue **and** 6 minutes: (light) brown	allow black ignore purple do **not** allow light blue allow yellow / orange	1	AO3 2.5.2b Prac
3(b)(iii)	any **two** from: • take each reading more than once • use colour standards for deciding end-point • test more pH values between 6 and 8 **or** test at smaller pH intervals • test at shorter intervals • same temperature (in a water bath)	ignore take more readings allow compare with another group allow use a colorimeter ignore wider range of pH unqualified allow example – e.g. every half min	2	AO3 2.5.2b Prac

4.7.3.3 Land use

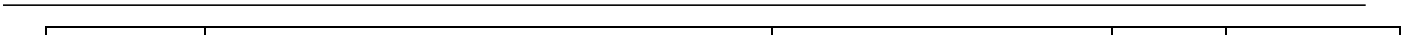
Answer 41 · Mark scheme

3(b)(iv)	no reaction **or** stays (dark) blue **or** takes >9 minutes enzyme denatured	allow takes longer allow description of denaturing, i.e. shape change allow description of trend on graph	1 1	AO2/3 2.5.2a/b
Total			**8**	

4.7.3.3 Land use

Answer 41 · Mark scheme

June 2017 | BL2HP | Original Q3 | Legacy



4.7.3.3 Land use

Answer 42 · Mark scheme

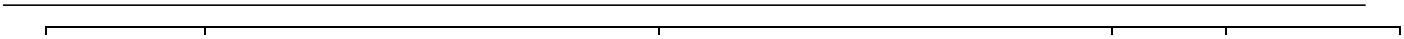
June 2017 | BL3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	xylem transports mineral (ions) phloem transports sugars	allow xylem transports water allow phloem transports sucrose / glucose / carbohydrate ignore minerals / ions transported in phloem if no other marks given allow one mark for xylem and phloem	1 1	AO1 3.2.3a
5(b)(i)	lost the most water **or** lost water faster than the others (it) has the greatest number of stomata (per mm^2) (and) water is lost through the stomata	allow mass decreased the most	1 1 1	AO3 3.1.3d
5(b)(ii)	(transpiration rate would be) lower (because) slow(er) evaporation / diffusion (into the air) **or** (because) concentration gradient will be less (due to) high(er) humidity	at least one comparative must be given allow 'lower rate of evaporation' for these 2 marks allow air becomes saturated	 1 1 1	AO2/3 3.1.3d
Total			**8**	

4.7.3.3 Land use

Answer 42 · Mark scheme

June 2017 | BL3HP | Original Q5 | Legacy



4.7.3.3 Land use

Answer 43 · Mark scheme

June 2018 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	toxins / poisons (secreted by / from / in bacteria)		1	AO1 4.3.1.3
01.2	any **two** from: • wash hands after using toilet / being sick **or** wash hands before preparing / handling food **or** do not prepare food (whilst infected) • isolate yourself • disinfect clothes / surfaces • do not share utensils / cutlery / towels	ignore 'wash hands' unqualified ignore reference to coughing / sneezing allow examples of how isolation could be achieved	2	AO2 4.3.1.1
01.3	antibiotics	allow named examples of antibiotics	1	AO1 4.3.1.8
01.4	immune system is damaged / weakened **or** immune system doesn't function properly white blood cells cannot kill bacteria / *Salmonella* (as effectively)	allow immunocompromised allow lack of / no white blood cells allow no / fewer antibodies so bacteria not killed **or** less phagocytosis so bacteria not killed **or** no / fewer antitoxins to counter toxins	1 1	AO2 4.3.1.2

4.7.3.3 Land use

Answer 43 · Mark scheme

June 2018 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any **one** from: • (give chickens) antibiotics • don't sell infected chickens / eggs • keep infected chickens isolated / indoors • slaughter the infected chickens	allow (give chickens) monoclonal antibodies allow don't sell the chickens / eggs ignore don't sell chickens / eggs allow keep the chickens indoors ignore keep chickens indoors ignore vaccination / chlorination / disinfection	1	AO1 4.3.1.3
01.6	(cleaning liquid) B **and** greater reduction in number of bacteria (after cleaning) in both locations	ignore few bacteria in both locations allow neither / both **and** idea of experimental error	1	AO3 4.1.1.6 4.3.1
01.7	radius (of area with no bacteria growing)	allow diameter (of the area with no bacteria growing) ignore πr^2 unqualified allow idea of placing agar plate onto graph paper and counting the squares not covered with bacteria	1	AO2 4.1.1.6

4.7.3.3 Land use

Answer 43 · Mark scheme

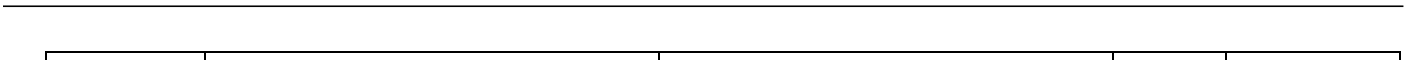
June 2018 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	repeat **and** look to see if results are similar	ignore repeat unqualified allow repeat **and** look to see if results are different allow repeat and see if there are anomalies ignore repeat and identify anomalies ignore repeat and compare unqualified	1	AO3 4.1.1.6
01.9	any **one** from: • toxicity / side / health effects • effect on other types of bacteria / pathogens • interaction with other cleaners • ease of use • dilution factor of each cleaner (vs. cost) • time cleaner is effective for	 ignore harmful / dangerous allow reference to allergies allow not tested on other types of bacteria ignore germs ignore concentration unqualified ignore how long the cleaner lasts for allow reference to odour of cleaning liquid ignore reference to cost unqualified ignore environmental effects / flammability	1	AO3 4.1.1.6
Total			**11**	

4.7.3.3 Land use

Answer 43 · Mark scheme

June 2018 | 8461/1H | Original Q1



4.7.3.3 Land use

Answer 44 · Mark scheme

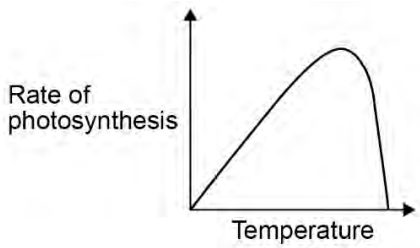
June 2019 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	LHS: carbon dioxide **and** water RHS: glucose	words take precedence over symbols allow correct symbols (ignore balancing) in any order do **not** accept starch ignore carbohydrates / sugar	1 1	4.4.1.1 AO1
03.2	power output of bulb		1	4.4.1.2 AO2
03.3	any **two** from: • repeat **and** calculate a mean **or** repeat **and** to eliminate anomalies • control the (water) temperature • control the concentration of carbon dioxide • control the distance of the bulb from the pondweed • control the mass / length / species / age of the pondweed • give pondweed time to equilibrate	ignore do a control experiment unqualified allow a method of controlling (water) temperature allow a method of controlling carbon dioxide concentration allow use the same piece of pondweed allow do experiment with the bulb off / in the dark	2	4.4.1.2 AO3
03.4	3.3 (cm^3/hour)		1	4.4.1.2 AO2

4.7.3.3 Land use

Answer 44 · Mark scheme

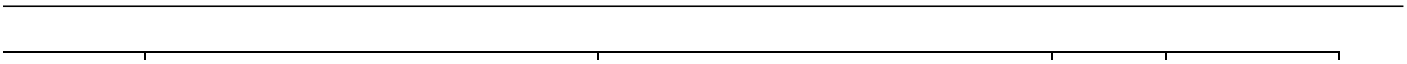
June 2019 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	correct scale **and** axis labelled	max **3** marks for bar chart	1	4.4.1.2 AO2
	all points plotted correctly	allow points plotted to within ± ½ small square allow 3 or 4 correct plots for **1** mark allow correct plot from incorrect value calculated in question **03.4**	2	
	correct curved line of best fit	ignore line extended beyond 60 / 250 (W) ignore line joined point to point with straight lines	1	
03.6	correct answer from their line drawn on **Figure 4**	allow ± ½ small square tolerance allow 1.8 / 1.9 if no line of best fit or incorrect graph is drawn	1	4.4.1.2 AO2
03.7			1	4.4.1.2 AO2
Total			**12**	

4.7.3.3 Land use

Answer 44 · Mark scheme

June 2019 | 8461/1H | Original Q3



4.7.3.3 Land use

Answer 45 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	primary consumer		1	AO2 4.7.2.1 4.7.4.1
01.2	correct shape: 4 tiers with largest at bottom and smallest at top correctly labelled: dragonfly / nymph + hydra + daphnia + algae	 in this order **or** allow: 3rd-order **or** tertiary consumer **or** apex / top predator **or** (trophic level) 4 2nd-order **or** secondary consumer **or** (trophic level) 3 1st-order **or** primary consumer **or** herbivore **or** (trophic level) 2 producer **or** (trophic level) 1 allow for **2** marks inverted pyramid if correctly labelled	1 1	AO2 4.7.4.2
01.3	any **one** from: (Daphnia biomass smaller because) • non-digestible parts (of algae) or lost in faeces • not all absorbed • lost in urine / urea • used in respiration **or** lost as carbon dioxide / CO_2 • algae not all eaten **or** eaten by other organisms • some algae decompose	 ignore waste allow excretion allow (to supply energy) for movement / warmth allow used to supply energy	1	AO1 4.7.4.3
01.4	 14 14 000	an answer of 14 000 scores **2** marks allow evidence of an incorrectly calculated mean × 1000 allow 1.4×10^4	 1 1	AO2 4.7.2.1

4.7.3.3 Land use

Answer 45 · Mark scheme

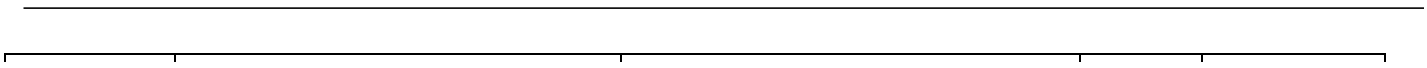
June 2019 | 8461/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		an answer of 2.625×10^4 **or** 2.63×10^4 **or** 2.6×10^4 scores **4** marks an answer of 26250 scores **3** marks allow ecf from Question **01.4**		AO2 4.7.2.1
	(volume of pond =) 1.875 **or** 2.5 × 1.5 × 0.5	an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps	1	
	14 000 × 1.875	allow ecf from Question **01.4**	1	
	26250		1	
	2.625×10^4	allow 2.63×10^4 **or** 2.6×10^4	1	
01.6	increased (growth / reproduction of) algae		1	AO2 4.7.2.1 4.7.3.2
	(more algae so) more food for Daphnia		1	4.7.4.1
		allow fertiliser toxic to Hydra (1) (so) fewer Daphnia eaten (1)		
01.7	(Hydra have) less food		1	AO3 4.7.2.1
	because (graph shows) fewer Daphnia (with more fertiliser)		1	4.7.3.2
		allow other valid suggestions, eg fertiliser toxic to Hydra (1) **or** fertiliser causes growth of algae (on surface) which block light and so die and decay **or** eutrophication (1) (decay / eutrophication) uses up oxygen (so lack of oxygen for Hydra) (1)		
Total			**14**	

4.7.3.3 Land use

Answer 45 · Mark scheme

June 2019 | 8461/2H | Original Q1



Answer 46 · Mark scheme

November 2020 | 8461/1H | Original Q1

The full source mark scheme begins on page 116. Follow original question 1 in that document.

Answer 47 · Mark scheme

November 2020 | 8461/1H | Original Q6

The full source mark scheme begins on page 116. Follow original question 6 in that document.

4.7.3.3 Land use

Answer 48 · Mark scheme

November 2020 | 8461/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	bacteria fungi	allow singular allow mould ignore microbes / germs / decomposers do **not** accept viruses	1 1	AO1 4.7.2.2 4.7.2.3
01.2	fatty acid(s)		1	AO2 4.7.2.3 4.2.2.1 RPA10
01.3	any **one** from: • universal indicator (paper / solution) • pH meter	allow UI (paper / solution) ignore pH paper unqualified allow pH probe ignore datalogger unqualified ignore Cresol red ignore phenolphthalein / litmus	1	AO1 4.7.2.3 RPA10
01.4	any **two** from: • volume of milk • exposure to air / oxygen • sterilise test tubes • treatment of milk before investigation • freshness / age of milk (at start) • time of day pH was measured	allow amount of milk allow bungs on test tubes allow example such as pasteurised or not allow starting pH of milk	2	AO1 4.7.2.3 RPA10
01.5	almond (milk)		1	AO3 4.7.2.3 RPA10

Answer 48 · Mark scheme

November 2020 | 8461/2H | Original Q1

01.6	as temperature increases up to 15 °C the time taken (to reach pH 5) decreases above 15 °C the time taken (to reach pH 5) stays the same	allow converse if no other mark awarded allow **1** mark for as temperature increases the time taken (to reach 5 °C) decreases and then stays the same	1 1	AO2 4.7.2.3 RPA10
01.7	any **one** from: • bacteria / microbes / microorganisms / fungi dividing faster (when warmer) • reactions (in the bacteria) are happening faster (to decay milk) • (because there is) more (kinetic) energy • enzyme activity is higher (at 10 °C than at 5 °C)	allow converse if clearly describing 5 °C allow number of bacteria / microbes / microorganisms / fungi increasing (when warmer) allow more bacteria microbes / microorganisms / fungi allow particles move faster allow more collisions between particles allow enzymes work faster ignore enzymes work better	1	AO2 4.7.2.3 4.1.1.6 RPA10
01.8	any **two** from: • different concentration / type of fat / lipid • different concentration / type of proteins / carbohydrate / sugar • different (amount / type of) bacteria present • may have been pasteurised by a different process • different starting pH	allow different amounts of fat / lipid allow different amounts of proteins / carbohydrate / sugar allow may have been treated in different ways (before the investigation) ignore different oxygen concentration	2	AO3 4.7.2.3 RPA10

4.7.3.3 Land use

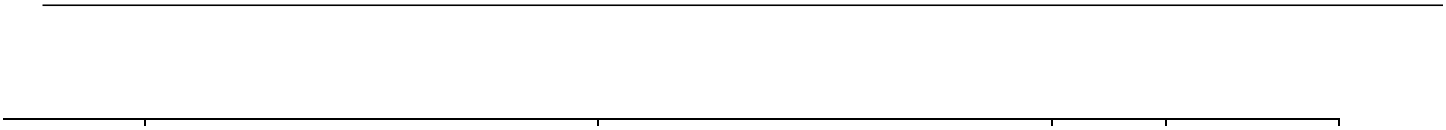
Answer 48 · Mark scheme

01.9	determine the types of bacteria present in the milk		1	AO3 4.7.2.3 RPA10
Total			**13**	

4.7.3.3 Land use

Answer 48 · Mark scheme

November 2020 | 8461/2H | Original Q1



4.7.3.3 Land use

Answer 49 · Mark scheme

November 2020 | 8461/2H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	$\frac{6.0}{1.6}$ 3.75	allow a range of 5.9 to 6.1 for 6.0 do **not** accept if a unit is given if no other marks awarded, allow a correct answer using a value of 5.8 or 6.2 for **1** mark	1 1	AO2 4.7.3.2
02.2	$\frac{2.5 - 1.6}{50}$ 0.018 (billion per year)	allow $\frac{0.9}{50}$	1 1	AO2 4.7.3.2
02.3 view with Figure 2	suitable extrapolation line on Figure **2** reading taken at 2050 from student's line	allow straight extrapolation allow a tolerance of ± ½ small square allow **1** mark for 10 billion if no extrapolation drawn	1 1	AO2 4.7.3.2
02.4	fewer fish caught **or** limit the number of fish caught (remaining fish) can reproduce	allow a method of doing this, eg increase mesh size **or** do not catch young fish allow more fish (survive to) reproduce	1 1	AO1 4.7.5.1 4.7.5.3

4.7.3.3 Land use

Answer 49 · Mark scheme

November 2020 | 8461/2H | Original Q2

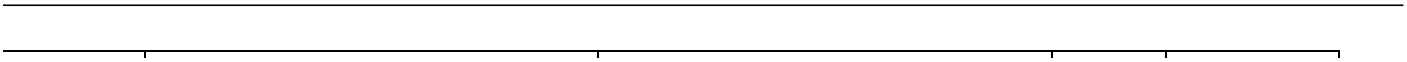
Question	Answers	Mark	AO / Spec. Ref.
02.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6	AO1 4.7.3.1 4.7.3.2 4.7.3.3 4.7.3.4 4.7.3.6 4.7.3.5 4.7.5.1 4.7.5.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content **human land use** • increasing population requires more food • crops / livestock for food • farming crops for biofuels • peat use as compost • peat use as fuel • increased use of pesticide / insecticide / herbicide / fertilisers • use of free-range / organic methods increases land use (for same yield) **link to biodiversity** • deforestation • monocultures • loss of hedgerows (to make fields larger) • loss of habitat • consequence of loss of habitat eg (change in) migration • fertiliser run off polluting water • use of pesticide / insecticide / herbicide reduces insects / plants which damages food chains • more soil erosion **link to atmospheric pollution** • more carbon dioxide (from farm animals / machinery) • more methane (from cows) • climate change **or** global warming • example of impact on biodiversity • acid rain • desertification Answers referring to only land use or only biodiversity are level 1		

02.6	golden rice has improved nutritional value		1	AO1 4.7.5.4
02.7	any **one** from: • gene may contaminate / enter other breeds / species • reduction / extinction of population of wild / traditional rice • reduction / extinction of population of flowers / insects • high cost of seeds • may have too much vitamin A (in diet)	ignore references to religious beliefs allow decrease in biodiversity allow decrease in gene pool allow may harm (human) health allow may cause side effects (on humans) ignore may harm humans unqualified	1	AO3 4.6.2.4
Total			**16**	

4.7.3.3 Land use

Answer 49 · Mark scheme

November 2020 | 8461/2H | Original Q2



4.7.3.3 Land use

Answer 50 · Mark scheme

November 2021 | 8461/1H | Original Q5

05.1	amino acid(s)	ignore monomers	1	AO1 4.2.2.1
05.2	salivary gland pancreas small intestine	in any order ignore mouth allow duodenum / ileum do **not** accept large intestine ignore intestine unqualified all three correct for **2** marks two correct for **1** mark	2	AO1 4.2.2.1
05.3	starch / substrate binds to <u>active site</u> (of enzyme) (because) shape of <u>active site</u> and substrate are complementary a chemical reaction occurs to produce smaller molecules **or** bonds between the (starch) molecules are broken to produce smaller molecules	ignore starch / substrate fits <u>active site</u> (of enzyme) allow shape of starch / substrate and <u>active site</u> allow them to fit together allow maltose / sugars for smaller molecules	1 1 1	AO1 4.2.2.1
05.4	any **two** from: • time before mixing (starch and amylase) solutions • volume / 5 cm^3 of starch (solution) • volume / 1 cm^3 of amylase (solution) • volume / 1 drop of mixture added to spotting tile • volume / 2 drops of iodine (solution)	ignore time unqualified allow amount as an alternative to volume once only do **not** accept temperature	2	AO2 4.2.2.1 RPA5
05.5	to allow the solutions to reach the same temperature as the water **or** to allow both solutions to reach 5 °C	allow so the solutions can equilibrate with the temperature of the water	1	AO2 4.2.2.1 RPA5

05.6	as temperature increases, (amylase / enzyme) activity increases, to 35 °C after which activity decreases	ignore reference to time	1	AO3 4.2.2.1 RPA5

05.7		allow enzyme for amylase and substrate for starch throughout		AO2 4.2.2.1 RPA5
	(iodine is not yellow-brown because) starch is still present **or** starch has not been broken down		1	
	at 5 °C amylase / starch / molecules have low (kinetic) energy		1	
	(therefore) there are fewer (enzyme-substrate) collisions	allow fewer enzyme-substrate complexes are formed	1	
	at 80 °C the amylase has been denatured	do **not** accept the amylase is killed / has died allow the shape of the amylase / active site changes	1	
	(so) the starch can no longer fit	allow the bonds holding the amylase in its (3D) shape have broken	1	

05.8	keep temperature constant		1	AO3 4.2.2.1 RPA5
	(but) change named factor **and** test a range of values of named factor	named factor e.g. pH **or** enzyme concentration **or** substrate concentration **or** inhibitor concentration	1	

Total			**17**

4.7.3.3 Land use

Answer 50 · Mark scheme

November 2021 | 8461/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.7.3.3 Land use

Answer 51 · Mark scheme

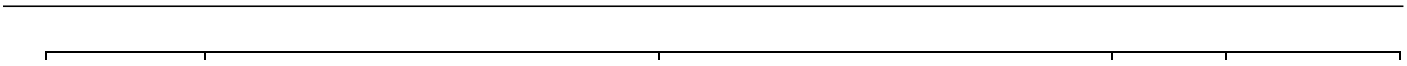
November 2021 | 8461/2H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(put beaker in a) water bath	allow (put beaker in an) incubator	1	AO1 4.7.2.3 RPA10
02.2	volume of the milk **or** type of milk	allow amount of milk allow named type of milk, eg cows' or semi-skimmed	1	AO1 4.7.2.3 RPA10
02.3	correct scale and axis labelled all points plotted correctly suitable curved line of best fit	scale must be at least 1 cm for 1 day allow a tolerance of ± ½ small square allow 4 or 5 correct plots for **1** mark ignore line joined point to point with straight lines	1 2 1	AO2 4.7.2.3 RPA10
02.4	similar shaped line drawn to left of 20 °C line on **Figure 4** same start pH	 allow a tolerance of ± ½ small square allow from student's line of best fit or student's plot for 0 days	1 1	AO2 4.7.2.3 RPA10
Total			**8**	

4.7.3.3 Land use

Answer 51 · Mark scheme

November 2021 | 8461/2H | Original Q2



4.7.3.3 Land use

Answer 52 · Mark scheme

November 2021 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	from light / sunlight absorbed by chlorophyll / chloroplasts	ignore sun unqualified if no other mark awarded allow by photosynthesis for **1** mark	1 1	AO1 4.7.2.1 4.7.4.3 4.4.1.1
07.2	krill / herring / copepod		1	AO2 4.7.2.1 4.7.4.1
07.3	algae		1	AO2 4.7.2.1 4.7.4.1
07.4	1 algae 2 krill **or** copepod 3 squid 4 mackerel (5 Human)	all correct for **1** mark	1	AO2 4.7.2.1
07.5	any **two** from: (losses due to) • non-eaten parts (of squid / krill) • <u>respiration</u> **or** <u>respiring</u> (in mackerel) • excretion (by mackerel)	 allow bones / shells allow eaten by other animals do **not** accept respiration produces / makes / creates energy allow loss of a named waste product such as CO_2 / urea ignore loss of waste unqualified ignore faeces	2	AO1 4.7.4.3

4.7.3.3 Land use

Answer 52 · Mark scheme

November 2021 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	2.3 **and** 0.1 (million)	allow in the range 2.25 to 2.3 for 2.3 (million)	1	AO2 4.7.5.3
	$\frac{2.3 - 0.1}{2.3} \times 100$ **or** $\frac{220}{2.3}$		1	
	95.65217.....	allow answer from correct substitution of incorrect values from **Figure 11**	1	
	96	allow student's calculated answer correctly rounded to the nearest whole number	1	

4.7.3.3 Land use

Answer 52 · Mark scheme

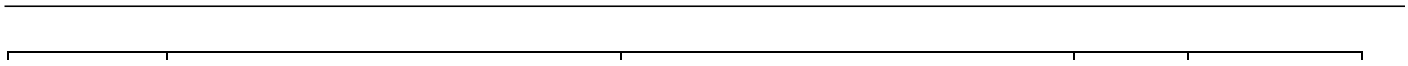
November 2021 | 8461/2H | Original Q7

Question	Answers	Mark	AO / Spec Ref.
07.7	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.7.5.3
	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 figures may be given without units (million tonnes) throughout **points for:** • small fish are not caught so can live long enough to reproduce • biomass / stocks have generally increased after these laws introduced • '77-'81 law (total ban) resulted in increase in biomass, eg 0.1 to 0.48 **or** to 0.9 by '84 • '84 law (mesh size) resulted in increase in biomass, eg 0.9 to 1.8 (by '90) • '97 law (quotas) resulted in increase, eg 1.15 to 1.25 • '98 law (ban in breeding season) resulted in increase, eg 1.25 to 2.5 **points against:** • could be a cause other than the law **or** correlation does not necessarily indicate causal relationship **or** other factors • laws superimposed so can't necessarily tell the effect of each • each law results in an increase followed by a decrease • quotas lead to dead fish being thrown back into sea For **Level 3** points both for and against must be considered together with appropriate use of data		
Total		**17**	

4.7.3.3 Land use

Answer 52 · Mark scheme

November 2021 | 8461/2H | Original Q7



4.7.3.3 Land use

Answer 53 · Mark scheme

June 2022 | 8461/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		must be in this order		AO1 4.1.1.1 4.1.1.2
	nucleus	allow chromosomes allow plasmid	1	
	(site of aerobic) respiration	allow makes ATP **or** releases energy do **not** accept produces / makes / creates energy do **not** accept anaerobic respiration	1	
	(cell) membrane		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	photosynthesis	allow produce glucose / sugar allow to absorb (sun) light ignore contains chlorophyll	1	AO1 4.1.1.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	root (hair)	allow xylem / phloem / epidermis / meristem	1	AO1 4.1.1.3 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	concentration of salt solution		1	AO1 4.1.3.2 RPA3

4.7.3.3 Land use

Answer 53 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to make sure **only** the potato mass was measured **or** if water / solution / liquid was left on (the potato), the mass would be higher / affected	allow (to) remove **excess** water / solution / liquid do **not** accept if water / solution / liquid was left on (potato) the mass would be lower ignore to remove water / solution / liquid on the outside / surface (of potato)	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$\frac{0.2}{2.5} \times 100$ 8(%)	allow $\frac{2.7 - 2.5}{2.5} \times 100$ if no other mark awarded allow **1** mark for $\frac{2.5 - 2.7}{2.5} \times 100 = -8\ (\%)$	1 1	AO2 4.1.3.2 RPA3

4.7.3.3 Land use

Answer 53 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 Mark with 01.8	correct scale **and** axis labelled (concentration (of salt solution) in mol/dm^3)	max **3** marks for bar chart scale must take up at least 50% of grid	1	AO2 4.1.3.2 RPA3
	all points plotted correctly	allow a tolerance of ± ½ small square allow 3 or 4 correct plots for **1** mark	2	
	curved line of best fit	ignore line extended beyond 0.4 mol/dm^3 ignore line joined point to point with straight lines	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 Mark with 01.7	correct answer from their line drawn on **Figure 1**	allow a tolerance of ± ½ small square ignore line joined point to point with straight lines if a line of best fit is drawn if no line of best fit is drawn, allow an answer in the range 0.31 – 0.33 (mol/dm^3)	1	AO2 4.1.3.2 RPA3

4.7.3.3 Land use

Answer 53 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	<u>water</u> moves out of cells / potato	allow 'pieces' for potato throughout	1	AO2 4.1.3.2 RPA3
	by osmosis	allow by diffusion through a partially / selectively / semi permeable membrane	1	
	(because) the solution in the cells / potato is less concentrated than outside **or** (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water concentration</u> / <u>potential</u> ignore reference to amount of water or salt do **not** accept water moves from an area of high (solute) concentration to an area of low (solute) concentration	1	

Total Question 1		17

Answer 54 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$\frac{9.96 \times 10^{-3}}{1.35 \times 10^{-4}}$ 73.77… 74 (:1)	if no answer in answer space allow answer in **Table 6** allow $\frac{0.00996}{0.000135}$ allow a correctly derived whole number from an incorrect calculation do **not** accept if unit is given	1 1 1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	as size increases, (surface area to volume) ratio decreases	allow they are inversely proportional **or** they are negatively correlated allow as one increases, the other decreases allow as size decreases, (surface area to volume) ratio increases	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	**D** has a smaller surface area to volume ratio (than **B**) (so) diffusion distance is too large (to meet demands of cells / organism)	allow converse for **B** throughout allow (so) diffusion takes too long (to meet demands of cells / organism)	1 1	AO3 AO2 4.1.3.1

4.7.3.3 Land use

Answer 54 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		allow converse for **E** throughout		AO3
	D has a larger surface area to volume ratio **and** so will lose heat more quickly (per unit volume than **E**)	allow **D** has a larger surface area to volume ratio **and** so temperature of **D** will drop more quickly ignore **E** loses more heat (overall)	1	AO2
	(**D**) requires greater rate of respiration		1	AO2
	(as) respiration is a (large) part of metabolism		1	AO2
	(so) need to generate more <u>heat</u> (to keep itself warm)	allow (so) needs to release more <u>heat</u> (to keep itself warm) do **not** accept energy produced / made / created	1	4.1.3.1 4.4.2.1 4.4.2.3

4.7.3.3 Land use

Answer 54 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.3.1 4.1.3.3 4.2.2.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • **both** have a large surface area o to maximise diffusion • **both** have thin walls **or** have walls that are one cell thick o to reduce diffusion distance / time • **both** are in close proximity to blood supply o to reduce diffusion distance / time • **both** have a good blood supply **or** both have a capillary network o to maintain concentration gradient • villi have microvilli o to (further) increase surface area • cells of villi contain many mitochondria o for active transport For **Level 2** reference to functions of structural details of **both** alveoli and villi is required.		

Total Question 6		**14**

4.7.3.3 Land use

Answer 55 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any **one** from: a change in • DNA • base code **or** nucleotide sequence • a base (in DNA) • a gene / allele • part of a chromosome • number of chromosomes • genetic code / material	ignore genetic information	1	AO1 4.6 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	16 / sixteen		1	AO3 4.7.2.1 RPA9

4.7.3.3 Land use

Answer 55 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	*volume of sample in mm³* 0.004		1	AO2 4.7.2.1 RPA9
	number of cells in 1 mm³ ***diluted*** *pond water* 14 ÷ 0.004	allow 14 ÷ (0.2 × 0.2 × 0.1) allow use of an incorrectly calculated volume of 0.04	1	
	3 500	allow ecf from answer to q.07.2 for number of algal cells	1	
	correct dilution factor ¼	allow dilution = ×4 **or** 4 times	1	
	number of cells in 1 mm³ ***undiluted*** *pond water* 3 500 × 4	allow a calculation based on a dilution factor of 5	1	
	14 000 **or** 1.4×10^4		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	to make it easier to count	ignore easier to see **or** more spread out ignore quicker to count	1	AO3 4.7.2.1 RPA9

4.7.3.3 Land use

Answer 55 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	smaller volume	allow (some) liquid / cells would leak out (from under the cover slip)	1	AO3 4.7.2.1 RPA9
	so fewer cells **or** lower cell count	allow this mark **only** if there is an attempt at an explanation	1	

Total Question 7		**11**

Answer 56 · Mark scheme

June 2023 | 8461/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	(*lhs*) $H_2O + CO_2$ **and** (*rhs*) O_2	in either order	1	AO1 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	from 0 to 5 000 lux		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	any **one** from: • use (different) coloured bulb(s) / LED(s) • use (different) coloured filter(s) in front of lamp • put (different) coloured transparent material(s) over lamp / beaker	allow named transparent material(s)	1	AO2 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	*independent* colour of light *dependent* time (taken for 10 leaf discs to reach the surface of the solution)	allow wavelength of light ignore colour of filter / bulb / lamp	1 1	AO2 4.4.1.1 4.4.1.2 RPA6

4.7.3.3 Land use

Answer 56 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.5	any **one** from: • so that discs would sink (to the bottom of the beaker) • so any gas (that makes the discs rise) is from photosynthesis • air is a gas so any left in discs would add to the oxygen produced by photosynthesis	allow leaf for disc throughout allow so the discs do not float ignore reference to carbon dioxide allow as a control variable	1	AO2 4.4.1.1 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.6	(sodium hydrogencarbonate) provides / releases carbon dioxide (carbon dioxide is used) for photosynthesis	ignore (sodium hydrogencarbonate) contains carbon dioxide ignore provides water	1 1	AO2 4.4.1.1 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.7	oxygen was produced in photosynthesis oxygen / gas is trapped in / around disc / leaf	allow bubbles are trapped in / around the disc / leaf allow oxygen / gas (makes leaf discs) less dense than solution / water allow the oxygen / gas under the disc / leaf pushes the disc / leaf up	1 1	AO1 AO2 4.4.1.1 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.8	to absorb / use many / more colours / wavelengths of light	allow to increase the rate of photosynthesis ignore to absorb as much light as possible do **not** accept to absorb all colours / wavelengths of light	1	AO2 4.4.1.1 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.9	chlorophyll absorbs most **or** a lot of blue light	if neither mark awarded allow **1** mark for chlorophyll absorbs more blue light (than green light)	1	AO3
	chlorophyll absorbs least **or** very little **or** not much green light	allow chlorophyll reflects most of the green light	1	AO3
	(so) discs in blue light took the least time to rise (to surface) because they photosynthesised faster / more **or** (so) discs in green light took the most time to rise (to surface) because they photosynthesised slower / less		1	AO2
	use of data (from **Figure 10** and **Table 6**) eg approximately 80% of blue light absorbed		1	AO2 4.4.1.1 4.4.1.2

Total Question 6	**15**

Answer 57 · Mark scheme

June 2023 | 8461/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	(0 to 6h): in the dark so (only) respiration occurs	ignore reference to animals allow no / limited light so (only) respiration occurs allow night(time) so (only) respiration occurs	1	AO2 4.7.1.2 4.7.2.2 4.4.1.2 4.4.2.1
	(respiration) produces carbon dioxide		1	
	(8 to 12h): in the light so photosynthesis (rate) is faster than respiration (rate)	allow in the light so more photosynthesis than respiration allow day(time) so more photosynthesis than respiration do **not** accept no respiration	1	
	idea of net / overall uptake of carbon dioxide	allow uptake of carbon dioxide by photosynthesis is greater / faster than output by respiration	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	field of maize only takes in carbon dioxide for 6 months of the year (compared to all year)	answers must be comparative allow converse argument allow maize takes in carbon dioxide for a shorter amount of time	1	AO3 4.7.2.4 4.7.3.4 4.7.3.3
	(and) field of maize takes in less carbon dioxide per day than rainforest		1	

4.7.3.3 Land use

Answer 57 · Mark scheme

June 2023 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	for comparison		1	AO2
	(because) different areas started with different numbers (of species)	do **not** accept (because) different areas started with different numbers of trees	1	AO3 4.7.2.4 4.7.3.1 4.7.3.4 4.7.3.6 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	any **one** from: • number of tree species increased rapidly at first • the number of tree species increases more slowly later • rate of increase of number of tree species decreases with time • beyond about 50 years there were more tree species than in the original rainforest • there was (great) variability of number of tree species from one study area to another at the same time	ignore answers referring to numbers of trees unqualified allow it takes 45 to 55 years for the forest to recover (the number of species) ignore biodiversity increases	1	AO3 4.7.2.4 4.7.3.1 4.7.3.6 4.7.3.3

4.7.3.3 Land use

Answer 57 · Mark scheme

June 2023 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.5	more / different types of food available	ignore more food available	1	AO2 4.7.2.4 4.7.3.1 4.7.3.6 4.7.3.3
	more / different types of habitat / shelter **or** nest sites available	allow more / different habitats	1	

Total Question 6	11

4.7.3.3 Land use

Answer 58 · Mark scheme

June 2024 | 8461/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	lack of oxygen for (aerobic) respiration	do **not** accept ref to respiration in dead plants	1	AO3
	(so) less / no energy (released)	do **not** accept energy produced / made / created	1	AO2
	(for) microorganisms / bacteria / fungi / microbes / decomposers **OR** low pH denatures enzymes (1) (so) less / no (chemical) reactions / metabolism / respiration **or** less **/** no energy released (1) in microorganisms / bacteria / fungi / microbes / decomposers (1)	allow low pH / acidity reduces enzyme activity do **not** accept energy produced / made / created	1	AO2 4.2.2.1 4.4.2.1 4.7.1.2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	34 g/m^2/year		1	AO2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	DNA		1	AO1 4.6.1.5 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	protein		1	AO1 4.4.1.1 4.4.2.1 4.4.2.3 4.7.1.2 4.7.1.4

4.7.3.3 Land use

Answer 58 · Mark scheme

June 2024 | 8461/2H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	increase in temperature	allow global warming allow heat (energy) is trapped ignore reference to greenhouse gases	1	AO3
	(because) carbon dioxide is released (from the peat bog)		1	AO2
	(because) carbon dioxide is produced by burning / decay of peat	ignore methane is released from burning / decay of peat allow fewer plants to take in carbon dioxide (for photosynthesis)	1	AO2
	(because) methane is released (from the peat bog)		1	AO2
				4.4.2.1 4.7.2.3 4.7.3.3 4.7.3.5

Total Question 2	10

4.7.3.3 Land use

Answer 59 · Mark scheme

June 2024 | 8461/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • collect more samples each time • collect samples more frequently • use a bigger bucket / sample • do not return tadpoles until after the fourth sample • sample at the same time of day • randomise collecting positions • collect at range of depths • standardised sweeps with a net instead of a bucket	allow suggested time interval allow a method to avoid double counting tadpoles	1	AO3 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	6	if no answer on line, allow answer in **Table 1**	1	AO2 4.7.2.1 RPA9

Answer 59 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	correct linear scale and axis labelled weeks	scale must use at least half available space	1	AO2 4.7.2.1 RPA9
	all points plotted correctly	allow a tolerance of ±½ small square allow 4 or 5 correct plots for **1** mark	2	
	curved line of best fit	ignore line drawn point to point	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	correct value at 0 and 4 weeks from line on student's graph, eg 60 and 22	allow a tolerance of ± ½ small square	1	AO2 4.7.2.1
	correct calculation eg $\frac{22}{60} \times 100$		1	
	36.7	allow 37 or 36.6... allow correct calculation using values from the student's graph if no line drawn on Figure allow a calculation based on values of 60 and 24 for up to full marks if line drawn on Figure but data from table used (60 and 24) only mp2 and mp3 can be awarded	1	

4.7.3.3 Land use

Answer 59 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	any **two** from: • disease / (named) pathogens • being eaten **or** predators • lack of food • low oxygen (concentration in water) • change in temperature • change in pH • (some of the) pond dried out • toxic chemical	 allow competition for food ignore competition unqualified allow eutrophication allow lack of space allow named example such as sewage / fertiliser ignore pollution ignore waste	2	AO2 4.7.1.2 4.7.1.3

Total Question 3	11

4.7.3.3 Land use

Answer 60 · Mark scheme

June 2024 | 8461/2H | Original Q4

Question 4

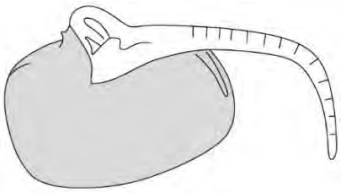
Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	to prevent (direction of) light affecting the results **or** to prevent (direction of) light affecting growth (of roots)	allow to prevent phototropism ignore ref to shoot allow so **only** gravity affects results / growth ignore as a control variable	1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	to prevent water affecting the direction of root growth to provide enough water for root growth		1 1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	to compare (with apparatus **A**) (so) it shows that gravity caused the results in apparatus **A** **or** (because) gravity acted equally in all directions (in apparatus **B**) **or** to cancel out the (one-sided) effect of gravity	allow to see the difference (between **B** and **A**) ignore reference to auxin ignore to cancel out gravity	1 1	AO3 4.5.4.1 RPA8

Answer 60 · Mark scheme

June 2024 | 8461/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	root drawn bending downwards root drawn longer than at start ink marks spread out in bent region	 do **not** accept ink marks spread out before the bend example: 	1 1 1	AO2 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	(in B) horizontal	allow (grows) straight (out) allow not bent (at all)	1	AO2 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	uneven distribution of auxin (so) upper side grows faster / more (than lower)	allow more auxin on the lower side ignore more auxin on upper side allow lower side grows slower / less (than upper)	1 1	AO1 AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7	any **two** from: • weed killers • rooting (powders) • (promoting) growth in tissue culture	 allow to grow plants from cuttings ignore reference to shoots allow inhibiting lateral buds	2	AO1 4.5.4.2

4.7.3.3 Land use

Answer 60 · Mark scheme

June 2024 | 8461/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.8	any **two** from: • promote / start / initiate / force flowering • more fruit • bigger fruits	allow to grow more flowers if neither given allow bigger yield (of apples) allow idea of fruits ripening simultaneously	2	AO2 4.5.4.2

Total Question 4	15

4.7.3.3 Land use

Answer 61 · Mark scheme

June 2025 | 8461/1H | Original Q3

Question 3

Question	Answers	Mark	AO / Spec Ref.
03.1	**Level 3**: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO3
	No relevant content.	0	4.1.3.2 RPA3

	Indicative content: *(strengths)* • same / a / one plant / potato used • all potato pieces used were cubes • mass was recorded before and after • change in mass was calculated • different concentrations of salt solution were used *(improvement and reason)* • use the same / a / one potato for all pieces o (because the student) may have used different potatoes • remove skin **or** peel the potato o (because) skin (may still be) present • blot / dry cube before measuring mass o (because) cube will have excess water on surface • use same / set size / surface area of potato piece each time o (because) size / surface area of cubes not controlled / specified • repeat (whole investigation **or** at each concentration) o (because there were) no repeats o to spot anomalies • calculate mean (from repeats) o (because there was) no mean calculated • same time for each piece to be in solution o (because) length of time in solution not specified • control temperature of solution using water bath o (because) temperature (of solution) not controlled / specified • use same volume of solution for each piece of potato **or** ensure all pieces are completely submerged o (because) volume of solution not specified / controlled • calculate percentage change in mass o (because) percentage change in mass not calculated **or** (because) each potato piece had a different starting mass • include control experiment with boiled cube o (because) no control experiment included • increase the number of concentrations (of salt solution) used o (because) only 3 different concentrations (of salt solution) used For **Level 3**, a strength and improvements / reasons must be included.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.2	the solution in the potato cells was more concentrated than the distilled water		1	AO2 4.1.3.2

4.7.3.3 Land use

Answer 61 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	any **one** from: • requires energy • (transports substances) against / up a concentration gradient • transports minerals / ions (and not water)	ignore it is active allow it is not passive allow (transports substances) from low concentration to high concentration ignore (transports substances) along / across the concentration gradient do **not** accept (transports substances) down a concentration gradient allow transports other named substances such as glucose allow does not transport water	1	AO2 4.1.3.2 4.1.3.3

Total Question 3	8

4.7.3.3 Land use

Answer 62 · Mark scheme

June 2025 | 8461/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	to remove all / the water	allow to make sure there is no water left allow to make sure the soil is (completely) dry ignore to remove water unqualified	1	AO3 4.7.1.2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$\frac{71}{252} \times 100$ 28.1(746…) 28 (%)	 allow student's incorrectly calculated percentage using mass data for 20 metres, rounded to nearest whole number	1 1 1	AO2 4.7.1.2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	as distance increases the percentage of water increases	allow positive correlation allow as one increases the other increases allow as one decreases the other decreases ignore directly proportional	1	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **two** from: • repeat (at each distance) **and** calculate a mean • test at intermediate / further distances • test around more / different trees • test at different angles around the (same) tree	allow repeat (at each distance) **and** remove / identify anomalies allow test more areas	2	AO3 4.7.1.2 4.7.2.1 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	any **three** from: • light (intensity) • temperature • type of soil • pH (of soil) • minerals / ions (in soil) • wind (intensity / direction) • oxygen in soil	} if neither awarded allow shade for **1** mark ignore sun allow acidity / alkalinity (of soil) allow salts **or** named examples of ions, such as nitrate allow fertiliser ignore nitrogen / nutrients ignore (availability of) space ignore carbon dioxide	3	AO2 4.7.1.1 4.7.1.2 4.7.2.1 RPA9

Total Question 2	10

4.7.3.3 Land use

Answer 63 · Mark scheme

June 2025 | 8461/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	for burning / combustion as compost	allow as a fuel allow for growing plants ignore as fertiliser allow to improve soil drainage / texture / quality allow as a building material allow as animal feed / supplement	1 1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	the variety of (all) <u>species</u> on Earth **or** the variety of (all) <u>species</u> in a habitat / area / ecosystem / community	allow the number of (all) <u>species</u> on Earth allow the number of (all) <u>species</u> in a habitat / area / ecosystem / community	1	AO1 4.7.3.1

Question	Answers	Mark	AO / Spec. Ref.
05.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.7.2.4 4.7.3.1 4.7.3.3 4.7.3.5
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical thinking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1–2	
	No relevant content	0	
	Indicative content • (destruction of peat) causes decrease in biodiversity locally / globally ***Local effects*** • causes death / extinction of (local) populations / species o (due to) loss of (specialised) habitat o (so) lack of food o (so) lack of shelter • causes migration of (local) populations / species o (due to) loss of (specialised) habitat o (so) need to find food o (so) need to find shelter ***Global effects*** • (removal of peat) releases (trapped) carbon dioxide • (removal of peat) releases (trapped) methane • burning peat releases carbon dioxide • decay of peat releases carbon dioxide (from respiration of microorganisms) • decay of peat releases methane (from anaerobic respiration of microorganisms) o (causes) global warming **or** greenhouse effect o (causes) climate change **or** extreme weather o (causes) melting ice caps **or** rising sea levels **or** flooding o (causes) drought / desertification **or** changing rainfall patterns o (causes) loss of food / habitats o (so) migration patterns change o (so) some species / organisms become extinct For **Level 2**, must refer to local and global effects with an explanation. For **Level 3**, must give an explanation for local and for global effects supported by other details for local and / or global effects.		

Total Question 5	**9**

4.7.3.3 Land use

Answer 64 · Mark scheme

June 2025 | 8461/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	15 cm		1	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2		allow correct conversion to milliseconds at any point in the calculation		AO2 4.5.2.1 RPA7
	substitution $t = \sqrt{\frac{2 \times 16}{980}}$ (seconds)	allow $t = \sqrt{\frac{32}{980}}$ (seconds)	1	
	correct answer t = 0.18070... (seconds)	all subsequent marks can be awarded using an incorrectly calculated value	1	
	conversion to milliseconds t = 180.7 (milliseconds)		1	
	rounding to 3 significant figures 181 (milliseconds)	allow student's incorrectly / not converted answer correctly rounded to 3 significant figures	1	

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	any **two** from: • use ruler with smaller / mm divisions • align 0 cm on ruler with **top** / **bottom** of (student's **B**'s) thumb • same distance between (student **B**'s) finger(s) and thumb • (student **B)** supports arm / hand / wrist / elbow on bench / table • use same hand (each time) • convert distance to time • allow drop ruler without warning **or** drop ruler at random time intervals	allow use a ruler with a more precise scale allow use a ruler with a better resolution ignore use a more accurate ruler allow same starting position of ruler above (student **B**'s) hand allow make sure (student **B**'s) hand is stationary allow use dominant **or** non-dominant hand each time allow use of mechanical / electronic device to hold and drop ruler allow idea of controlling distraction / caffeine / sleep / alcohol allow use a computer program (to measure reaction time)	2	AO3 4.5.2.1 RPA7

4.7.3.3 Land use

Answer 64 · Mark scheme

June 2025 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	receptor (in eyes) detect stimulus / movement	allow retina detects stimulus / movement	1	AO1 4.5.2.1 4.5.2.2
	impulses generated / transmitted / travel	allow electrical signals generated / transmitted / travel ignore messages / information	1	4.5.2.3
	(from) sensory neurone (to relay neurone) to motor neurone		1	
	(along) optic nerve to brain	ignore CNS / spinal cord	1	
	chemical crosses synapses between neurones		1	
	effector / muscle in fingers / hand / arm contracts (to catch the ruler)		1	

Total Question 7	13

AQA

GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final

206G8461 1H/MS

4.7.3.3 Land use

MARK SCHEME – GCSE BIOLOGY – 8461/1H – JUNE 2020

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives, level of demand and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	*before arrow* carbon dioxide **and** water *after arrow* glucose	allow correct chemical symbols ignore any attempt at balancing equation ignore light / chlorophyll either order ignore sugar / carbohydrate do **not** accept starch	 1 1	AO1 4.4.1.1
01.2	<u>light</u> (light) is captured / trapped / absorbed by chlorophyll / chloroplasts	ignore description of subsequent parts of the photosynthesis reaction allow sun<u>light</u> ignore sun allow (light) is used by chlorophyll / chloroplasts	 1 1	AO1 4.1.1.2 4.4.1.1
01.3	$\frac{18.5 + 19.3 + 19.5}{3}$ **or** $\frac{57.3}{3}$ 19.1 (cm^3/hour)	 allow an answer correctly calculated using only two correct values	1 1	AO2 4.4.1.2 RPA 6
01.4	a ring around 14.2	allow clear indication of correct result	1	AO3 4.4.1.2 RPA 6

01.5	any **one** from: • scale / value was misread • there was air / oxygen in the syringe / measuring cylinder / apparatus • the lamp / light was moved • temperature changed • had different mass / length of pondweed • pondweed had not acclimatised	ignore human error ignore references to counting bubbles or time allow measurement error allow light intensity changed ignore different bulb / lamp unqualified	1	AO3 4.4.1.2 RPA 6
01.6	did not use it in calculation (of mean)		1	AO3 4.4.1.2 RPA 6
01.7	any **one** from: • light (intensity) • carbon dioxide (concentration) • pondweed size / amount • pondweed species	do **not** accept temperature ignore time allow distance / power / colour of lamp / light allow same (piece of) pondweed	1	AO3 4.4.1.2 RPA 6
01.8	enzyme(s) lose the shape of the active site	allow enzyme(s) (start to) denature allow enzyme(s) destroyed / damaged do **not** accept enzyme(s) killed	1	AO2 4.2.2.1

4.7.3.3 Land use

01.9	y-axis labelled '(rate of) photosynthesis in cm^3/hour'		1	AO2 4.4.1.2 RPA 6
	suitable scale on y-axis	must take up half or more of grid provided	1	
	all points plotted to within ± ½ small square	allow 3 or 4 correct plots for **1** mark ignore any attempt to plot a point at 20 °C	2	
	correct curved line of best fit	ignore line joined point to point with straight lines ignore extrapolation	1	
Total			**16**	

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	movement / spreading out of molecules / particles	allow movement / spreading out of (named) substances / chemicals / gases / liquids ignore reference to membranes / cells	1	AO1 4.1.3.1
	from (an area of) high(er) concentration to (an area of) low(er) concentration	allow down / with the concentration gradient ignore along / across the concentration gradient do **not** accept movement from / to a concentration gradient	1	
02.2	increased carbon dioxide concentration in the air		1	AO2 4.1.3.1 4.2.3.2
	increased number of stomata that are open		1	

4.7.3.3 Land use

02.3	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.1.3.1 4.2.2.2 4.2.2.3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	

	Indicative content
	• (many) alveoli
	  • provide a large(r) surface area (**:** volume)
	
	• capillaries are thin
	  or alveoli / capillary walls are thin **or** one cell thick
	  or capillaries are close to the alveoli
	  • which provides short diffusion path (for oxygen / carbon dioxide)
	
	• breathing (mechanism) moves air in and out
	or lungs are ventilated
	  • to bring in (fresh) oxygen
	  • to remove carbon dioxide
	  • to maintain a concentration / diffusion gradient
	
	• large capillary network (around alveoli)
	or good blood supply
	  • to remove oxygen(ated blood) quickly
	  • to bring carbon dioxide to the lungs quickly
	  • to maintain a concentration / diffusion gradient		

02.4	osmosis	allow diffusion	1	AO1 4.1.3.1 4.2.3.2 4.1.3.2
02.5	active transport (because) energy is needed (to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell)	 allow (to move nitrate ions) against / up the concentration gradient allow (because) there is a lower concentration (of nitrate ions) in the soil **or** (because) there is a higher concentration (of nitrate ions) in the root / cell ignore reference to amount / number of nitrate ions ignore along / across the concentration gradient do **not** accept if reference to molecules / atoms moving	1 1 1	AO3 AO2 AO2 4.1.1.3 4.2.3.2 4.1.3.3
Total			**14**	

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: (both have) • cytoplasm • (cell) membrane • DNA / genetic material • ribosomes	ignore reference to shape allow RNA ignore genetic information if no other mark awarded allow sub-cellular structures for **1** mark if no other mark awarded allow correct cellular process, e.g. respiration for **1** mark	2	AO2 4.1.1.1 4.1.1.2 4.1.2.1
03.2	any **three** from: • prokaryotic cell is smaller • prokaryotic cell has no mitochondria • prokaryotic cell has no nucleus **or** DNA is free in the cytoplasm **or** genetic material is free in the cytoplasm • prokaryotic cell has a single loop of DNA **or** prokaryotic cell has a single loop of genetic material • prokaryotic cell has plasmids	allow converse for eukaryotic cells allow reference to bacterium instead of prokaryotic cell ignore reference to features not shown in Figure **5** if neither mark awarded, allow prokaryotic cell has no membrane-bound organelles ignore genetic information ignore genetic information ignore circular / rings of DNA allow prokaryotic cells have smaller ribosomes	3	AO2 4.1.1.1 4.1.1.2 4.1.2.1

03.3	1 µm = 0.001 mm **or** 1 mm = 1000 µm **or** 0.05 mm = 50 µm **or** 0.05 × 1000 (1:) 50	 do **not** accept if a unit is given	1 1	AO2 4.1.1.1 4.1.1.2
03.4	mitosis	correct spelling only	1	AO1 4.1.2.2
03.5	35%		1	AO2 4.1.2.2
03.6	 (stage 1) DNA / chromosomes replicate / duplicate mitochondria / ribosomes / sub-cellular structures increase in number **or** mitochondria / ribosomes / sub-cellular structures replicate (stage 2) one set of chromosomes is pulled / moved to each end of the cell (stage 3) the cytoplasm **and** cell membrane divides (to form two cells)	ignore names of the stages of the cell cycle ignore genetic material ignore DNA / chromosomes double / reproduce allow cytoplasm increases ignore cell grows unqualified allow one of each chromosome is pulled / moved to each end of the cell ignore nucleus divides allow cytoplasm divides **and** (new) cell membranes form ignore nucleus divides	 1 1 1 1	AO1 4.1.2.2
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	fatty acids		1	AO1 4.2.2.1
	glycerol		1	4.4.2.3
04.2	enzyme binds to the substrate because they are complementary (shapes)	allow enzyme joins to the substrate because they fit together exactly allow enzyme joins to the substrate because the substrate fits the active site ignore reference to specificity do **not** accept same shape	1	AO2 4.2.2.1
	(so) substrate is broken down (into products)	allow (so) substrate splits (into products) ignore products are formed, unqualified	1	
	(so) products are released **or** enzyme is not changed	allow enzyme is not used up allow reference to activation energy for either marking point 2 **or** marking point 3	1	
04.3	each <u>active site</u> has a specific shape (so only fits one type of lipid molecule)	allow each <u>active site</u> is a different shape do **not** accept reference to the substrate having an active site	1	AO2 4.2.2.1
04.4	add Benedict's (solution / reagent to the liquid)		1	AO1 4.2.2.1 RPA 4
	boil / heat	allow any temperature of 65 °C or above	1	
	(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick)red		1	

04.5	add iodine solution / reagent (to the liquid) (if starch is present) it changes colour to blue / black (from yellow / orange / brown)	allow add a drop of iodine ignore iodine unqualified	1 1	AO1 4.2.2.1 RPA 4
04.6	glucose from photosynthesis (excess) glucose converted to starch	do **not** accept starch made in photosynthesis allow (excess) glucose is stored as starch	1 1	AO2 4.2.2.1 4.4.1.1 4.4.1.3 4.4.2.3
04.7	starch (stores) have been converted to glucose (so the glucose can be) used for respiration / (named) metabolic reactions **or** (so the glucose can be) used to release energy (because) there is no light to make (new / more) glucose by photosynthesis	ignore reference to residual glucose from previous photosynthesis do **not** accept idea of energy being produced / created / made	1 1 1	AO3 4.4.1.1 4.4.2.1 4.4.1.3
04.8	any **one** from: • test roots / stems of plants (in the light and dark) • test other species of plant • measure the concentrations of glucose **and** starch • vary the time in the dark / light • test variegated leaves	do **not** accept reference to changing the independent variable allow test other parts of the plants allow test other types of plant ignore mass / amount allow any other valid extension ignore repeats	1	AO3 4.4.1.2 4.4.1.3
Total			**17**	

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	mechanical	allow physical allow structural	1	AO3 4.3.3.2
05.2	any **one** from: • to deter herbivores • to prevent animals damaging it	ignore to injure animals, unqualified allow to deter animals eating it do **not** accept to deter predators	1	AO2 4.3.3.2
05.3	chemical		1	AO3 4.3.3.2

05.4	any **two** from : • lack of magnesium (ions) (1) (so) not enough chlorophyll for (efficient) photosynthesis (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • infection by pathogen / bacteria / virus / fungus (1) (so) leaves become discoloured / yellow so less photosynthesis (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • infected by aphids (1) (which) remove sugars from phloem (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • lack of (available) light (1) (so) chlorophyll breaks down (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1)	allow (so) lack of chlorophyll produced causes yellow leaves (1), (so) not enough photosynthesis to produce glucose which is used to make proteins for growth (1) allow correctly named pathogen allow has rose black spot / TMV allow other symptoms of named pathogens / disease award once only award once only award once only	5	AO2 4.3.3.1 4.3.1.1 4.3.1.2 4.3.1.4 4.4.1.1 4.4.1.2 AO1 4.4.2.3 4.4.1.3

4.7.3.3 Land use

05.5	(bacteria) obtain glucose / sugar (from the plant) (glucose used) for respiration **or** (glucose used) for making other named substances	 allow (glucose used) to release energy	1 1	AO3 AO2 4.2.3.2 4.4.1.3
05.6	(gorse plant) obtains nitrate (ions) needed for amino acids / proteins	 allow needed to make chlorophyll / DNA	1 1	AO2 4.1.3.3 4.4.2.3 AO1 4.3.3.1
05.7	willow bark		1	AO2 4.3.1.9
Total			**13**	

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any **two** from: • BMI / morphology / obesity level • smoking habits • diet • medication • family history of liver disease • fitness levels • ethnicity • area of UK they live in	ignore genetic factors allow mass / weight **and** height allow previous drinking habits allow medical conditions allow drug use allow level of exercise allow race	2	AO3 4.2.2.6
06.2	2.55 – 1.60 (= 0.95) $\left(\frac{0.95}{2.55} \times 100 = \right)$ 37 (.2549019608…) (%)	allow 1.60 – 2.55 (= –0.95) allow value for with meals in range 1.60 to 1.65 (for 1.60) allow answer correctly calculated from values in ranges 1.60 to 1.65 and 2.50 to 2.60 allow – 37(.2549019608...)(%)	1 1	AO2 4.2.2.6
06.3	12 × 2 × 7 = 168 (g/week) 1.8	 allow in range 1.8-1.9 allow correct reading from a calculation that omits the 2 **or** the 7 do **not** accept if a unit is given	1 1	AO2 4.2.2.6

4.7.3.3 Land use

06.4	any **two** from: • consuming alcohol increases the RR (with / without meals) **and** supporting data • consuming less than 50 g/week of alcohol with meals does not increase the RR • even (small amounts of alcohol at) 25 g/week increases the RR if not with meals	allow risk for RR throughout allow data in terms of number of glasses of wine allow increasing alcohol consumption increases the RR at an increasing rate allow any value between 35 and 60 g/week	2	AO3 4.2.2.6
06.5	any **two** from: • large number in survey • long term / 15 year survey • well controlled	allow 800 000 in survey if neither mark awarded allow large study allow many controls	2	AO3 4.2.2.6
06.6	any **one** from: • people underestimate / overestimate alcohol consumption • people may change (lifestyle / drinking) habits over time • some people may drink all their weekly alcohol at once	allow people lie about alcohol consumption **or** people lie about other named control variables ignore survey only tested women	1	AO3 4.2.2.6

06.7	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3-4	AO2 4.4.2.3 4.2.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-2	AO1 4.4.2.2 4.2.2.6 4.2.2.5 4.5.3.3
	No relevant content	0	
	Indicative content Responses may refer to either total or partial liver failure • no bile made (in the liver) ○ fats / lipids are not emulsified ○ surface area of fats / lipids not increased ○ pH of small intestine will not be alkaline / neutralised ○ enzymes (in small intestine) will not work effectively **or** (named) food not digested / absorbed ○ so may lose weight • lactic acid not broken down / oxidised ○ accumulation of lactic acid in blood / body ○ lactic acid is toxic **or** body will be poisoned ○ oxygen debt higher / prolonged ○ so muscle pain / fatigue • proteins / amino acids will not be broken down (in liver) ○ (amino acids) not deaminated ○ amino acids not made into urea **or** will not form ammonia ○ (however) any ammonia formed is toxic ○ so accumulation of amino acids in blood / body • liver does not break down / remove other toxins (like alcohol) ○ toxins accumulate in blood / body ○ body will be poisoned ○ so pain **or** jaundice **or** swollen liver **or** portal hypertension occurs • glycogen stores will not be formed ○ cannot control blood glucose ○ so hyperglycaemia / hypoglycaemia / diabetes / coma may occur		

Total			**15**

4.7.3.3 Land use

Question	Answers	Extra information	Mark	AO / Spec.Ref.
07.1		ignore add mAbs and dye to slide (unbound)		AO2 4.3.2.2
	bind fluorescent dye to mAbs		1	
	put (bound) fluorescent mAbs on the slide (and rinse off)		1	
	mAbs will bind to Candida albicans / pathogens and show up under the microscope	allow mAbs will bind to Candida albicans / pathogens and show up under UV (lamp)	1	
07.2	more Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells	allow Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells more quickly do **not** accept white blood cells produce antibodies do **not** accept lymphocytes engulf Candida albicans	1	AO2 4.2.2.3 4.3.1.6 4.3.1.7
	therefore less damage to cells / tissues / organs	ignore less toxin released (by Candida albicans)	1	

07.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6	AO1 4.3.1.9
	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 • given first to healthy volunteers ○ at (very) low dose ○ to test it is safe **or** to test for toxicity **or** to check for any side effects • then to some patients (with the disease) **or** people with the disease ○ to test for the correct / optimum dose ○ to check for any side effects ○ to test for efficacy **or** to test if it works ○ in a double blind trial ○ where neither patients nor doctors know who has the mAbs and who has a placebo (or alternative treatment) • reference to large trial **or** long duration **or** control variables		

07.4	any **one** from: • (the body will) not reject the mAbs **or** (the body is) less likely to reject the mAbs • mouse mAbs are (more likely to be) rejected • the human lymphocytes have already responded to that infection / cancer cell so they are known to work against the disease	do **not** accept idea of rejection of cells	1	AO3 4.3.2.2 4.3.2.1 4.3.1.6
Total			**12**	

Answer 43 · Examiner comments

June 2018 | 8461/1H | Original Q1

Question 1 (standard demand)

01.1 A correct answer had to refer to toxins or poisons, which are the cause of symptoms of a *Salmonella* infection. Though it was not required, if a source was given for the toxins or poisons, it had to be correct. Thus, an answer which referred to 'toxins from the virus' was not awarded the mark.

Other students who did not achieve this mark often referred vaguely to *Salmonella* interacting with the stomach or intestine.

01.2 The most common response from students which received no credit was simply 'washing hands'. A little more than this was required for a mark to be awarded ie **when** hands should be washed to help prevent the spread of the bacteria to other people eg after using the toilet.

Another common misconception was that the *Salmonella* bacteria are spread by droplet infection and hence an answer suggesting covering your nose or mouth when coughing and sneezing was not creditworthy.

Many students achieved credit for the suggestion of isolation as a method of preventing the spread of the pathogen between people. Many of these students suggested how this isolation could be achieved eg keeping away from other people.

01.3 The correct answer, 'antibiotics' was very well known with 94% of students achieving this mark.

01.4 The first mark required the idea that the immune system is not functioning correctly in a person with AIDS. This could be expressed in a variety of ways, such as the immune system being weakened.

The second mark was awarded for a reason the person with AIDS does not recover as quickly which could, for example, be achieved by explaining that white blood cells can't kill the bacteria.

More students gained the first marking point than the second one eg they knew that AIDS weakens the immune system but then did not go on to explain fully why this meant recovery from the *Salmonella* infection would take longer. A common misconception was the idea that the immune system would be too busy with AIDS, so unable to deal with the *Salmonella* infection.

4.7.3.3 Land use

Answer 43 · Examiner comments

01.5 The question required students to suggest what the farmer could do to prevent the spread of the transmission of *Salmonella* bacteria from chickens to humans. It was not what a person could do to avoid contracting the bacteria.

Despite vaccination already having been described in the question stem as one method, many students gave this as their response. This highlights the importance to students of reading every question stem very carefully.

Answers that simply referred to 'chickens' being (for example) isolated were not given credit, as it was not clear if students were referring to the infected chickens or to the healthy ones. Suggestions of improved hygiene or disinfecting were ignored. 46% of students correctly suggested killing or isolating the infected chickens.

01.6 Students needed to study the figure carefully and give a full answer if they were to achieve this mark. It was insufficient for them to refer loosely to liquid B 'killing more bacteria', or simply to the numbers of bacteria present after use of the liquids, as there are situations where this is not true. Further qualification was necessary, with a reference to both surfaces.

01.7 Many students made good and correct use of the term 'zone of inhibition'. This question was answered well with 57% of students correctly quoting either 'radius' or 'diameter'.

A number of students misinterpreted the question and gave answers explaining how to calculate the area rather than what measurement had to be made. Some students gave the formula πr^2 and did not explain that r was the radius of the area with no bacteria growing.

01.8 Many students did not show an understanding of the term 'repeatable' as stated in the AQA science subject vocabulary. They answered by suggesting that another scientist should carry out the investigation or that different bacteria or a different temperature should be used.

Some students just said 'repeat' or 'repeat and compare', neither of which were sufficient as the question also needed a reference to the idea of seeing **if** the results were similar.

01.9 Most students who achieved this mark did so by referring to possible toxicity of the cleaning liquid. Answers such as 'checking if it is harmful' were insufficient.

Students who had followed the theme of the question through also often referred to the effect on other types of microorganism. Students who did not achieve the mark often gave the factor that had already been investigated, the extent to which the liquid kills the (Salmonella) bacteria or referred to 'cost', despite having been told that the liquids cost the same per dm^3.

4.7.3.3 Land use

Answer 46 · Examiner comments

November 2020 | 8461/1H | Original Q1

Question 1 (standard demand)

The reference to 'energy' in **01.2** triggered some confusion, with some students discussing respiration rather than considering the context of photosynthesis.

In **01.5**, reference to 'human error' on its own was insufficient and students should always be reminded to add qualification. The concept of denaturation in **01.8** was misunderstood by several students (nearly 60% of students scored no marks), with plants denaturing, cells denaturing and 'it' denaturing commonly seen.

Students are advised to read and follow all of the instructions given when asked to draw a graph, as in **01.9**, many students missed key tasks despite them being listed clearly. Students need to understand how to draw a line/curve of best fit when the plots do not fall on a straight line and students generally could be more accurate when plotting points, particularly those that are not whole numbers. A few students plotted the three individual repeats for each temperature rather than the mean, which meant that no plotting marks could be awarded.

Answer 47 · Examiner comments

November 2020 | 8461/1H | Original Q6

Question 6 (standard/high & high demand)

Throughout this question many students missed out on marks because they had not read the stem of the question, and its supporting information, carefully enough. In addition, when the use of data is specifically asked for in a question, students need to provide the appropriate data to achieve full marks.

In **06.7**, many students could not comprehensively name one function of the liver, with many confusing its role with that of the kidney. Some students thought that digestive enzymes were produced in the liver and that bile neutralises the acid within the stomach, rather than in the small intestine.

4.7.3.3 Land use

Answer 48 · Examiner comments

November 2020 | 8461/2H | Original Q1

Question 1 (standard demand)

The topic was the decay of milk. **01.2** was not answered well, with just over one-third of the entire entry able to give 'fatty acids' as the product of lipid breakdown. Common errors were 'lipase' and 'amino acids'. 'Glycerol' was sometime stated in addition to fatty acids but inclusion of this forfeited the mark as it was not clear the student knew which one caused the pH to decrease.

In **01.4**, the need to control the volume of milk was frequently recognised, although some students forgot the aim of the investigation and qualified their answer unsuitably as cows' milk. Very few other correct answers were offered, the most common being the time of day when the pH should have been measured. A significant number of students repeated information already provided, including the duration of the investigation, or incorrectly suggested 'temperature' (which was the independent variable).

A large majority of students in **01.6** either misinterpreted the graph itself or the aim of the investigation. Thus, there were many descriptions of temperature and pH falling as time progressed. It was particularly common for students to interpret the y-axis as showing pH, despite it being clearly labelled as the time taken. Thus, fewer than one-third of students gained both marks here and many omitted any reference to data, as required by the question.

In **01.7** some students contradicted the information and described the reverse relationship, while others compared pH10 with pH5 rather than the time taken for reaction at 10 °C compared with that at 5 °C. Those who did gain the mark usually referred to enzyme activity, although some thought the enzyme would have denatured at 10 °C. Hardly any referred to a higher rate of division of microorganisms at the higher temperature.

Answer 48 · Examiner comments

November 2020 | 8461/2H | Original Q1

In **01.8** some students recognised that one possible cause was due to differences in composition between the different types of milk, often suggesting different amounts of lipid. Higher-attaining students also suggested different amounts of bacteria present or differences in the starting pH; however very few were able to offer two acceptable ideas.

4.7.3.3 Land use

Answer 49 · Examiner comments November 2020 | 8461/2H | Original Q2

Question 2 (standard demand)

The question was about human population increase and the problem of provision of sufficient food. For the calculation in **09.2**, both of the values required were given in the information, so it was not necessary to determine figures from the graph. Despite this, many students did attempt to, often incorrectly. For those who did show the correct numbers in their calculations, a large proportion used them incorrectly, often adding them and very few did the necessary calculation of dividing the difference by 50. Some just left the value at '0.9'. Others calculated the mean of the two given values rather than the mean annual increase. Fewer than half of the students were completely successful.

In **02.3** most students attempted to draw some sort of extrapolation on the graph; however, this was sometimes not linked to the trend shown by the line, rising a little, then plateauing or even taking a downturn. Students could still gain the second mark for reading the correct value from their own line. This was often not done accurately, particularly by students who continued their extrapolation beyond 2050 and read off the final population value. It was clear that students who simply read the scale, and gave answers such as '10' had not considered the implication that their answer of a human population of only 10, rather than 10 billion, is unlikely.

In **02.4** students showed some understanding of the term 'quota' and described limiting fishing in one way or another. However, this was as far as some got as they omitted the idea that the remaining fish would be able to reproduce, in order to maintain stocks. Lower-attaining students often suggested that a quota referred to the amount of fish that people could buy or eat. In **02.5** most students successfully linked the need for more farmland to an increasing population needing more food. References to the use of chemicals to enhance growth were only given very occasionally. In terms of reduced biodiversity, few students went beyond deforestation and habitat loss, although some suggested that the latter might result in migration of animals to find new habitats. There were only occasional references to methane and carbon dioxide production and an association of these with global warming. The question differentiated between students well.

Answer 50 · Examiner comments November 2021 | 8461/1H | Original Q5

Question 5 (standard, standard/high & high demand)

Many students were unable to access the marks available in **05.3** due to confusion over the difference between the enzyme and the substrate. Several students thought that starch was an enzyme or that amylase fitted into the enzyme. Few students referred to the shape of the active site needed for marking point 2 and many stated that the substrate fits into the active site, but did not go on to say that binding occurred. A lack of specificity of language was common in **05.4** with students referring to 'amount' regularly. A common response was temperature, despite this being the independent variable in the investigation. **05.6** was not answered well with common references to time rather than activity.

4.7.3.3 Land use

Answer 51 · Examiner comments — November 2021 | 8461/2H | Original Q2

Question 2 (standard demand)

This question was about the effect of temperature on the decay of milk, as followed by monitoring changes in pH. It related to Required Practical Activity 10.

Success was very mixed in the different parts of this question. Fewer than half were able to suggest that a water bath (or an incubator) could be used for keeping the milk at a constant temperature of 20 °C and, despite pH being the dependent variable, many suggested that it might be a variable that should have been kept constant.

A quarter of the students scored full marks for plotting the graph of the results. The major error was to draw a straight line instead of a curve through the plotted points. Some students also forgot to label the *x*-axis. The sketched line showing expected results at the higher temperature of 25 °C proved difficult for most students: most did not draw a line starting at the same pH as that for 20 °C and many did not indicate a faster fall in pH with time. In addition, approximately one-fifth of students made no attempt at sketching the line on the graph.

Answer 52 · Examiner comments — November 2021 | 8461/2H | Original Q7

Question 7 (standard, standard/high & high demand)

This question was about a marine food web and legislation to ensure sustainable fishing of herring in the North Sea. In **07.1**, almost two-thirds of students scored 1 mark for stating either that light was the source of energy for the algae or that the algae used photosynthesis. Many stated that the energy came 'from the Sun' which did not distinguish between light and other forms of solar energy. Incorrect answers included carbon dioxide, water, mineral ions and even from eating other organisms. 1% of answers mentioned that chlorophyll or chloroplasts absorbed the light energy.

Most students were able to identify a primary consumer and the producer in the food web in **07.2** and **07.3**, respectively. A common incorrect answer for the primary consumer was the 'human', presumably confusing primary with top. Similarly, around three-quarters of students were able to assign 5 organisms from the food web to a food chain ending in the human.

In **07.5**, although one reason for the lower biomass of the mackerel than that of the combined biomass of the krill and squid was given as non-digestibility of parts of these animals, many students suggested 'lost in faeces' as an additional reason. Around one-third of students gained some credit for their answers by suggesting losses due to respiration or excretion or, alternatively, that some parts of the krill and squid were not even eaten or they were eaten by other animals.

4.7.3.3 Land use

Answer 52 · Examiner comments

November 2021 | 8461/2H | Original Q7

07.6 was a 4-mark calculation of percentage decrease using figures read from a graph. Fewer than half of students were completely successful. Errors included the use of an incorrect starting point – the first and highest value on the graph for the year 1950 was quite a common error, or reading the value for 1977 as '0.2' or '0.05' instead of 0.1. Many students did not get credit for not rounding their answer to the nearest whole number as instructed in the question. Some calculated a percentage reduction in excess of 100%, the highest such value being '2300%'. Around one-sixth of students scored no marks.

07.7 was a 6-mark extended response question requiring the evaluation of the data from the graph in relation to various acts of legislation introduced at different times. Many students found this very difficult with more than two-thirds attaining no higher than Level 1. The question instructed students to use data from the graph and information from the diagram showing the relationship between mesh size of fishing nets and the sizes of herring of different ages. Many students did not cite any data, or did not consider all four pieces of legislation and their subsequent effects on herring biomass. It was rare to read any negative points – the most common being the decrease in biomass at certain times despite the legislation that had been introduced – and hardly any students thinking that causes in addition to the given legislation might have been responsible for the changes in biomass or that, since the acts of legislation overlapped in their application, it was hard to ascertain the effect of each. Very few students attempted to make a judgement on the basis of the points they had made and no-one scored all 6 marks.

4.7.3.3 Land use

Answer 53 · Examiner comments

June 2022 | 8461/1H | Original Q1

Question 1 (Standard demand)

01.1 Students' knowledge of sub-cellular structures was generally well evidenced in this question, with over 70% of students scoring full marks; however, the common error of referring to energy production / creation in the mitochondria was still seen. In addition, students often referred to energy being released 'for respiration', which is not creditworthy. There was also frequent confusion between cell membranes and cell walls.

01.2 Over 90% of students were able to correctly reference the function of chloroplasts. A few students simply stated that the role was to make the cell or plant green, which was insufficient.

01.3 65% of students were able to name a plant cell that was lacking in chloroplasts, however, several incorrect answers giving other types of cell (such as a bacterium), or other sub-cellular structures, were commonly seen.

01.4 Nearly 85% of students were able to correctly identify the independent variable in the investigation.

01.5 It was clear that many students had carried out the Required Practical Activity on osmosis assessed in this question. The three quarters of students who gained credit in this question were able to articulate the need to remove excess water, or that any extra water would add to the mass recorded, rather than just repeat the stem of the question.

01.6 The vast majority of students were able to use the equation provided to correctly calculate the percentage increase. Some students used an alternative method which would have led to a correct value if they had remembered to subtract 100 from their final answer. Students should therefore be reminded that, in questions where they are given an equation to use, they should use that equation to avoid missing out on vital marks.

01.7 Graph drawing skills still prove challenging for some students, and many make their lives more difficult by using unusual scales or, as often seen in this question, by shifting their *x*-axis scale. These ideas in themselves are acceptable, but only when the scales remain even and the zero is clearly identified, which often, they were not. While many students were able to plot accurately, a number incorrectly transcribed the reading of (0.3, 0.4) from the table, instead plotting the *x*-value at 4.0. Many students were unable to draw a correct curve of best fit, either drawing a straight line, or a curve that did not hit all of the points, or that was broken or 'feathered'. Curves of best fit should fall within ½ a small square of all of the points and should be a single, unbroken line. Students should also be reminded that their scale should take up at least 50% of the grid space provided.

01.8 Over a third of students understood the idea that where the curve crosses the x-axis is where there is no net loss or gain of water in osmosis, however, some students did not gain credit because of inaccurate readings. Again, readings must be within ½ a small square to be creditworthy.

4.7.3.3 Land use

Answer 53 · Examiner comments June 2022 | 8461/1H | Original Q1

01.9 As in previous years, many students continue to make the same error when describing 'concentration' in osmosis explanations and less than 45% of students gained full marks in this question. If water concentration is not specified, it is assumed that solute concentration is being described and this often results in an incorrect answer (for example, 'water moves from an area of high concentration to an area of low concentration' is **not** correct). Some students correctly articulate themselves in terms of water concentration, but then go on to contradict themselves with incorrect references to concentration gradients (again, solute is assumed unless water is specifically quoted).

Answer 54 · Examiner comments June 2022 | 8461/1H | Original Q6

Question 6 (Standard/high and high demand)

06.1 Over three quarters of students scored full marks in this question, selecting the correct numbers for surface area and volume from the table, dividing surface area by volume and then correctly rounding their answer of 73.77... to 74, the nearest whole number. Some students simply selected the correct numbers and wrote them as a ratio, but didn't progress to simplify this by dividing, so scored no marks. Another relatively common mistake that was seen was when students converted the standard form numbers to 'normal' numbers, but in doing so missed out one of the nines from 0.00996.

4.7.3.3 Land use

Answer 54 · Examiner comments

06.2 60% of students answered correctly, stating that as the size of the organism increased, the ratio decreased. The converse of this was also commonly seen and credited. A few noted the creditworthy relationship of inverse proportionality also. Students were asked for a relationship between two factors, but some did not refer to these factors in their response. This was the most obvious reason for students not achieving the mark. Some students got the relationship the wrong way round and others appeared to compare surface area to volume for each organism i.e. volume increasing as surface area increases, for example, stating that surface area is always bigger than volume.

06.3 Over 60% of students scored zero marks in this question. Just over 35% of students gained the first marking point, for the idea that organism **D** has a smaller surface area to volume ratio than organism **B**. Those that didn't achieve the mark failed to make their answer comparative. The converse was also credited. Very few students achieved the second mark point, which was for the idea that either the diffusion distance is **too** large or that diffusion would take **too** long. Many students just repeated the question stem and didn't mention the word diffusion.

06.4 This high demand question was not accessible to most students, with nearly 85% scoring zero marks. Most students recognised that **D** had a larger surface area to volume ratio, however failed to link this to losing heat more quickly. Some, but not many, realised that more respiration would be needed. Many students realised that metabolism is the sum of the chemical reactions in the body, but few made the link that respiration was a key part of it. Consequently, very few scored the final two marking points, with many students just stating that the rate of metabolism had increased, using information from the table in the question.

06.5 This levelled response question required students to make links between the adaptations of both villi and alveoli, which many students found difficult. The most common mark on this question was 1. Some students very competently described how the alveoli and villi are adapted to increase absorption. Some students, however, knew lots of detailed and correct information, but did not answer the question and refer to features of both alveoli and villi in their answer. Some answers lacked precision; many students lost marks referring to absorption rather than diffusion. There was also a number of references to thin membranes as opposed to thin walls. Other common mistakes were: the villi being one cell thick, reference to cell walls and the villi containing mitochondria, rather than the cells of the villi. Students who talked about both alveoli and villi and linked the adaptation to the correct consequence scored well.

4.7.3.3 Land use

Answer 55 · Examiner comments

June 2022 | 8461/2H | Original Q7

Question 7

This question was about the calculation of the population density of a microscopic unicellular alga and problems that might be encountered in the method of doing so.

07.1 Since the unusual colour of the alga had been caused by a mutation, students had to define the term *mutation*. Just under two-thirds understood that a mutation was a change in the genetic material, such as DNA, a base, a gene or a chromosome.

07.2 A description was given in the question of how a scientist set up a special slide with a counting grid in order to count the algal cells in a given volume of a suitably diluted sample of pond water. Section and plan diagrams of the special slide were given in **Figures 8** and **9**. Students then had to score the number of cells in a 0.2 mm × 0.2 mm square in **Figure 9**, observing the given rules for inclusion or exclusion of cells on the boundaries. Around three-quarters of students arrived at the correct answer of 16.

07.3 This question was a 6-mark calculation to find the number of algal cells in 1 mm^3 of undiluted pond water from a count of 14 cells in the 0.2 mm × 0.2 mm square. Many students presented their working in a manner that was very difficult to follow, with a series of mathematical operations that were clearly not equalities yet that were all interconnected with 'equals' signs. A large proportion of students regarded the volume of the sample on the special slide as being equal to 0.2 × 0.2 = 0.04, forgetting to multiply by the depth of 0.1 mm to obtain an actual volume of 0.004 mm^3. Some misinterpreted the scientist's dilution factor: 2.5 cm^3 made up to 10 cm^3 is a 4-fold dilution, not 5-fold as many thought. Many did not consider the dilution and ended up with an answer of 3500 (or 350 with the incorrect volume) instead of the correct value of 14 000.

The correct calculation was simply:

$$\frac{14 \times 4}{0.004} = 14\,000$$

but only around 1 in 8 students arrived at this answer.

4.7.3.3 Land use

Answer 55 · Examiner comments June 2022 | 8461/2H | Original Q7

07.4 To understand this question required thinking about the experimental situation and the results shown in **Figure 9**. If the pond water had not been diluted, there would have been 4 times the number of cells shown in **Figure 9** which would have made them impossible to count. Just over a quarter of students made any reference to the ease of counting. Some thought the algae would have been easier to see as the murky pond water had been diluted. Some answers were close – stating that dilution reduced the likelihood of cells overlapping – but did not then go on to state that they would thus be easier to count.

07.5 The original information about the scientist's investigation included mention of a thick coverslip over the sample. In this question, information was given about a student trying to repeat the investigation but with a thin coverslip that was pulled downwards slightly, and asking for an explanation of what difference this would make to the cell count. Fewer than half scored any marks and only one in six scored both marks for stating that the volume would be reduced and the cell count therefore also reduced. There were various, highly inventive but incorrect, ideas such as a thinner cover slip allowing light to pass through more easily so more cells would be counted, or that the curved coverslip would somehow refract the light and alter the count as a result. Many stated that the cell count would be 'altered' without being more specific about the direction of this alteration.

Answer 56 · Examiner comments June 2023 | 8461/1H | Original Q6

Question 6 (Standard, standard/high and high demand)

06.1 This question was well answered, with just over 87% gaining the mark. It is particularly pleasing to see that students are taking care with the size of the letters in chemical formulae and the correct use of subscript.

06.2 Almost 83% of students correctly identified 0 to 5000 lux as being the correct representation.

Y

4.7.3.3 Land use

Answer 56 · Examiner comments

06.3 While many students had the idea to use some form of coloured transparent material to change the colour of the light shining on the leaf discs, unfortunately, some of those students didn't state where this material should be placed, which was in this case critical to gain credit. Also, some suggested just using a different filter with no reference to changing the filter's colour, and again could not be awarded the mark. Over 61% of students did however, give a correct reason.

06.4 Around 20% of students correctly named at least one of the variables, and a further 67% correctly named both variables. A large number of students chose to give the full headings from the table which secured them the 2 marks. Some errors commonly seen were giving the independent variable as the rate of photosynthesis rather than the time for the discs to rise, or indeed naming the two variables the wrong way around.

06.5 While expressed in many ways, just under half of students recognised that the leaf discs would float straight away if they still had air in them, and thus gained the mark.

06.6 The majority of students struggled with this question, and almost two thirds scored zero marks. A common misconception seen was students trying to link their answer to osmosis. To gain credit students needed to convey the idea that carbon dioxide could be provided or produced by the sodium hydrogen carbonate, and not simply that it contained it, which saw some students miss out on the mark. To gain two marks, students needed to develop their answer further to link the carbon dioxide provision to photosynthesis. Only around 13% of students were successful in this and gained the full 2 marks available.

06.7 Over 58% of students scored some marks in this question, and most commonly for indicating that oxygen was produced during photosynthesis**.** There were many vague ideas given for the second marking point with students simply stating 'the discs floated', without explaining a possible cause for this. Over 40% gained neither of the marks.

06.8 Most students could interpret the graph and could identify that each chlorophyll absorbed some *different* wavelengths, but they failed to explain the advantage of this in terms of the combination of chlorophyll a and b collectively being able to absorb more or many wavelengths of light. Vague responses such as 'more light absorbed' was commonly seen and did not gain credit without reference to colour or wavelength. Only around 41% of students gained this mark.

06.9 This question proved a good discriminator with only 5% of students gaining the full 4 marks, and over a third of students gaining zero marks. Students did make a good attempt at this question however, failure to use good biological terminology often prevented them from gaining either of the first two marks (or the fallback) because they failed to mention it was *chlorophyll* that was responsible for absorbing the blue/green light. Similarly, many students also failed to link the colour of light and the time for the discs to rise with a *change in rate of photosynthesis*.

The 25% of students that gained just 1 mark, most commonly gained credit for correct use of data. For this marking point students had to use both Figure 10 and Table 5, and many of the successes were seen linking a correct figure for either the peak percentage of blue light absorbed, or the minimum percentage of green light absorbed. Some ignored the instruction to refer to Figure 10 and Table 5 and only quoted values from Table 5.

4.7.3.3 Land use

Answer 56 · Examiner comments

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

Answer 57 · Examiner comments June 2023 | 8461/2H | Original Q6

Question 6

This question was about the combined effects of respiration and photosynthesis on the carbon dioxide concentration in the air and the recovery of a rainforest community following deforestation.

06.1 Most students only considered the effects of photosynthesis in this question about changing carbon dioxide concentrations in the air in a tropical rainforest over a 24-hour period. For the first 6 hours shown in Figure 9 there was no light – hence only respiration took place and this produced carbon dioxide, hence the high levels of carbon dioxide shown on the graph. Many students understood that photosynthesis would not occur in the dark but then attributed respiration solely to animals in the forest. Between 8 am and 12 noon, the graph showed that carbon dioxide levels decreased. While most understood that the plants would be photosynthesising at this time, few realised that respiration also took place but the rate of photosynthesis exceeded that of respiration – hence a net uptake of carbon dioxide. Fewer than one-quarter of students reached even half-marks and only 1 percent scored all 4 marks.

Answer 57 · Examiner comments June 2023 | 8461/2H | Original Q6

06.2 Many students missed the concept of the time factor in answering this question which asked for an explanation why replacing rainforest with a maize crop would increase the carbon dioxide concentration in the air over one year. Using information from Figure 9 and Figure 10 should have indicated that maize removed less carbon dioxide from the air over the course of one day (not simply that the carbon dioxide concentration in the air decreased less at midday). Although many commented on the maize crop growing for just 6 months of the year, few stressed that this would mean the maize was only taking in carbon dioxide for half the year compared to the rainforest doing the same throughout the year. Only 1 in 40 students fully demonstrated their understanding of this situation.

06.3 Figure 11 showed an increase in the number of tree species with time following deforestation. The data were presented as percentages compared with adjacent control areas. About half of the students appreciated that presenting the data as percentages enabled comparisons to be made, but hardly any made the point that the initial numbers of species would have varied from one study area to another thus making a comparison of absolute numbers invalid. Mistakenly referring to the number of trees rather than to the number of tree species was quite common.

06.4 The stem to this question gave the information that the biodiversity of trees increased in the regenerating forest, but many restated this as their conclusion from the data in Figure 11. Further details from the data were required – such as the number of tree species exceeding the original number after about 50 years, or the fact that for any point in time there was great variability from one area to another, or a description of the changing pattern of recovery with time. Only 10 percent were successful here.

06.5 Many attributed the given increase in animal diversity in the regenerating rainforest to there being more food or more habitat available rather than to more variety of food types and more types of habitat.

4.7.3.3 Land use

Answer 58 · Examiner comments

June 2024 | 8461/2H | Original Q2

Question 2 (standard demand)

02.1 Some students appeared to be confused as to how decay happens, believing that the dead plant matter would decay itself. However, the majority of students did indicate that some sort of microorganism is involved in the decay process, gaining the third mark in the mark scheme. 40% of students gained at least 2 or more marks overall.

Some students spent time unnecessarily describing the factors needed for decay and often needed to extend their answers onto the additional pages.

There were two routes students could use to gain marks. Many students' answers included elements of both routes, so examiners awarded a mark for the described route which gave the higher mark. In most cases this was the first route given in the mark scheme.

The information in the question told students that layer B contains 'very little oxygen' and 'has a low pH'; thus, simply repeating either of these was insufficient to gain credit. To gain the first mark, students needed to link one of these pieces of information to their own knowledge, either in terms of respiration or in terms of enzymes being denatured or reducing in activity. Many students also gained this first marking point, although some who took the second route demonstrated confusion about what a 'low pH' constitutes, describing it as 'low acidity' or 'being 'alkaline'.

Achieving marking point 2 proved to be more problematic for many students, most simply by omitting any reference to energy or metabolism. Students should be advised that when referring to respiration in their answers (as many did), they should then go on to describe the role of respiration: 'releasing energy'. For those who did refer to energy, it was noted that very few described energy being 'produced', which is never acceptable as this would contradict the principle of conservation of energy.

02.2 Just under 70% of students identified the correct answer regarding the approximate biomass of moss that becomes biomass in primary consumers.

02.3 Half of students identified DNA as a substance that can be made using phosphates.

02.4 Around 65% of students could identify protein as the substance that can be made using nitrogen.

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4.7.3.3 Land use

Answer 58 · Examiner comments

June 2024 | 8461/2H | Original Q2

02.5 This was a well answered question, with almost all students gaining at least one mark, and 65% of those gaining three or more marks. A number of students described a rise in temperature of the Earth's atmosphere, gaining marking point 1.

It should be noted that the 'greenhouse effect' and 'climate change' are not equivalent to 'global warming'. A significant number of students attempted to describe the mechanism of global warming. This was often confused, including references to the 'ozone layer' and incorrect descriptions of long and short-wave radiation. However, such descriptions are beyond the requirements of the specification, so were ignored.

Students who merely repeated the information that the peat bog 'contains' carbon dioxide and methane could not be awarded marking points 2 or 4. Instead further added value was required, in that these gases would be 'released' from the peat when the bog was destroyed. A significant number of students omitted any reference to methane, so were unable to gain marking point 4.

Again, students should be advised that repeating the information in the question will not gain credit, such as those that described 'the use of peat as a fuel' releasing carbon dioxide. To gain credit here, students needed to indicate that the peat would have to be 'burned' to produce carbon dioxide. In this case, examiners ignored the idea that burning would also release (trapped) methane, as this would inevitably also be burned, releasing more carbon dioxide.

Answer 59 · Examiner comments

Question 3 (standard demand)

03.1 Just under 70% of students successfully identified an improvement to the method. The most common creditworthy responses were 'repeats', 'collect more water' or a description of avoiding double counting of the tadpoles. As the experimental time frame given was 8 weeks, improvements that suggested extending this time period were not given credit.

03.2 Over 95% of students correctly carried out the simple calculation. Students using the row rather than the column was the main reason to not score marks.

03.3 Students were asked to complete a graph to show how the total number of tadpoles changed over the 8-week period. Over 90% of students scored 3 or more marks, with a mark commonly missed for not labelling the *x*-axis or failing to use a linear scale.

Plotting the points was mostly done well and students that did lose the marks was due to accuracy as each small square vertically was 2 units. The line of best fit should have been a smooth curve through the points, but some students used a ruler to draw a straight line of best fit or simply joined the plots dot-to-dot – neither of which gained credit.

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4.7.3.3 Land use

Answer 59 · Examiner comments

June 2024 | 8461/2H | Original Q3

03.4 Students are asked to calculate the percentage of the tadpoles that would still be found in the pond at four weeks compared to zero weeks, using the data from their graph. Around 75% of students gained the full three marks for this calculation. Many students achieved marking point 1 only for using the values from their graph at 0 and 4 weeks. They then could not use the values correctly to determine the answer.

A common incorrect approach was to take the answer for 4 weeks away from 60 before multiplying by 100. A noticeable number of students chose not to use their graph but instead used data from the table, allowing some credit to be given as long as the values from the table were correct.

03.5 Over 65% of students gained full marks in this question for correctly suggesting two reasons why the tadpoles died. The most common correct answers were ‘not enough food’, and then reference to predators or disease. The most common uncreditworthy responses seen were vague references to changes in environment/conditions, lack of parental care and natural selection. Effects of the experimental method were ignored.

Answer 60 · Examiner comments

Question 4 (standard, standard/high and high demand)

04.1 Just over half of students knew why the student placed both sets of apparatus in the dark. Many answers referred to preventing phototropism to gain the marking point. Some students referenced control variables, which was insufficient to gain the mark. Many incorrect responses did include references to gravity, however the response was not qualified with 'only gravity' as per the mark scheme, so therefore could not be awarded the marking point. Vague responses such as 'to keep it a fair test' or 'to make sure nothing affects the investigation' also could not be credited. Other students did not refer to results/growth, for example, 'so light doesn't affect them'.

04.2 A third of students identified two reasons for surrounding the seedings with damp blotting paper, gaining full marks. A noticeable number of students only ticked one box and students are reminded to read the question carefully.

04.3 Around 45% of students gained one mark on this question, with a further 10% gaining both available marks. Marking point 1 was by far the most commonly awarded mark, with many students realising that Apparatus B was for a comparison. Marking point 2 was awarded much less often as many students lacked detail in their responses and could not be given credit. For example, many responses referenced that Apparatus B 'removes' or 'cancels' gravity rather than the *effect* of gravity. However, the correct representation of this alternative point was by far the most common seen for marking point 2. Some students only described the distribution of auxin which didn't answer the question, so were not credited.

04.4 In this question students were asked to complete a diagram of the root after 24 hours to show both the appearance and the ink marks expected. Almost one third of students gained full marks for their diagram. Students that drew the root completely straight were restricted to 1 mark, assuming they had drawn the root longer. The spacing of the ink marks in marking point 3 proved challenging for many students, often drawing them all equal, or adding in spaces before the bend which negated this mark.

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4.7.3.3 Land use

Answer 60 · Examiner comments

04.5 55% of students knew that the root would grow straight and gained the mark. However, a minority of students suggested that the root would grow 'straighter', which implies some bending and therefore, could not be credited.

04.6 Students were asked to explain how auxin causes the results in Apparatus A. Over 50% of students did not score anything on this question, with 20% gaining both available marks. Many students conveyed the idea of uneven distribution of auxin, but several students became confused as to which side of the root had the most growth. Other responses lacked comparative language when explaining the direction of growth and could not gain credit for marking point 2. Some responses referenced light affecting the auxin and just wrote about what they knew about auxin rather than addressing the question.

04.7 Just over 30% of students gained at least one mark for giving a use of auxin, with a further quarter of students gaining two marks. The use of auxin as weed killer, or a rooting powder were by far the most common correct answers given by students. Some responses just stated that auxins were used for growth, which was too vague at this level of demand. Many responses showed confusion between the roles of auxin and gibberellin (which was the focus of question 04.8).

04.8 15% of students gained full marks for knowing two reasons why the farmer sprayed the apple tree with gibberellin, with 45% of students being awarded at least one mark usually for the idea of 'more' or 'bigger' fruit. Many responses were awarded the fallback mark for referring to an increase in yield. Of the three alternative answers to this question, the promotion of flowering (bullet point 1) was the least common correct response.

A lot of responses referred to 'ending seed dormancy' which does not answer the question and therefore could not be credited. As with question 04.7, there was evident confusion between the roles of gibberellin and auxin.

Answer 61 · Examiner comments

Question 3 (standard demand)

03.1 This was a levelled, extended response question based on a required practical. Students were asked to evaluate a given method to investigate osmosis in pieces of potato. Students achieving Level 1 (11%) made very few relevant points. Students achieving Level 2 (78%) suggested further improvements to the method and often gave reasons as to why these might be required, but judgements were always incomplete. Students achieving Level 3 (10%) made full use of the command word 'evaluate' and considered both strengths and weaknesses of the method in addition to indicating the ways the method could be improved.

Few students gave responses which allowed them to match the Level 3 requirements. Most omitted any consideration of strengths, and their judgements were incomplete. Many, nevertheless, seemed confident in their attempts at answers and this was pleasing to see.

The question asked for ways to improve the validity of results, and these needed to be clear. Discussion of controlled variables such as size, time and volume required quantification, or clarification that they needed to be the same or specific on each occasion, rather than just 'similar', 'recorded' or 'precise'. A large number of students suggested that the mass of the cubes should be kept the same, but this was neither plausible, nor required.

The use of specific pieces of equipment only gained credit if they were linked to clear improvements to validity. Several responses referred to the use of a cork borer to obtain cylinders of potato but then did not add anything about the control of length; others suggested the use of stop watches but with no link to control of time.
Points which were frequently seen from the indicative content included drying the cubes before measuring mass, repeats and calculation of mean values and the use of more different concentrations. Some students focused on aspects such as safety considerations, tables of results, graphs or explanations of osmosis. These were not appropriate additions to an evaluation, which asked for ways to improve the validity of results. Discussion of a 'wider range' of concentrations was only relevant if mention was made of 'more than 3' values within it.

03.2 39% of students scored the mark in this question.

03.3 This question asked for one way in which active transport differs from osmosis. It was most easily answered by one clear, distinctive point about active transport being given, without any further mention of osmosis. 82% of students achieved the mark in this question. For BP2, it was common for students not to gain credit for including incorrect biology when describing osmosis, for example 'active transport goes from low to high concentration, but osmosis goes from high to low'. Incorrect reference to particles moving from a low concentration gradient to a high concentration gradient were seen more commonly than in previous years.

Answer 62 · Examiner comments

June 2025 | 8461/2H | Original Q2

Question 2 (Standard demand)

02.1
Students were given a method for an investigation into numbers of daisy plants growing in a field at different distances from the tree. Three quarters of students knew that the steps were repeated to remove all the water, or to ensure all the water had evaporated. Common incorrect answers seen included 'to improve accuracy', 'to identify anomalies' and 'to remove excess water'.

02.2
Students were given data from an investigation into the number of daisy plants growing at different distances from a tree. They were asked to calculate a percentage and give their answer to the nearest whole number. This calculation was attempted by over 95% of students, with a pleasing 80% being awarded the full 3 marks. Of the students that did not gain all 3 marks, those that showed their working out were able to gain one or two marks. Students should be encouraged to always show their working out for calculations.

02.3
A pleasing number of students were able to describe the effect of distance from the tree on the percentage of water in the soil – with almost 90% gaining credit. Students that simply stated 'it increased' did not gain credit as reference to both the distance and the percentage of water were required for the mark.

02.4
Students were asked to consider changes to the investigation that would increase the validity of the student's conclusion. Bullet point 1 was most commonly seen, although students stating simply to 'repeat it' without further qualification could not be given credit at this level of demand. Around 75% of students gained at least one mark for this question.

02.5
Around a quarter of students were able to suggest three abiotic factors that might have caused more daisy plants to grow further from the tree, with a further half of students gaining two of the available three marks. The full range of possible correct responses outlined on the mark scheme were seen, with light being the most common. A few students negated a correct abiotic factor by suggesting the tree (biotic) was the cause – for example 'shade from the tree'.
Vague answers such as 'soil' or 'weather' did not gain credit, and despite being told in the question not to refer to water, a small number of students referred to rainfall, humidity or drought which again could not be credited.

4.7.3.3 Land use

Answer 63 · Examiner comments

June 2025 | 8461/2H | Original Q5

Question 5 (Standard, Standard/high and High demand)

05.1
This question required students to give two uses of the peat removed from peat bogs. Over 50% of students gained one mark, with a pleasing 25% gaining both marks available. 'Combustion' and 'fuel' were the most common answers seen, with only 1% of students not attempting the question. The most common incorrect answer given was 'fertiliser', or a description of the role of fertiliser.

05.2
Only 40% of student gained the mark for correctly defining biodiversity. Those that fell short of the mark generally did so for not using the term 'species' in their answer. Some students referred to 'the species of plants and animals' which did not include all other species such as prokaryotes and so could not gain credit.

05.3
This was a levelled response question which was marked holistically.
Students were required to give a detailed explanation of how the destruction of peat bogs could affect biodiversity both in the local area **and** globally. Just over a third of students only gave a one-sided explanation of either the global or the local effects and consequently were restricted to Level 1.
Just over 10% of students gained credit in Level 3. Such answers included details of global and local effects of peat bog destruction, alongside clear explanations of the impact on biodiversity.
Around 40% of students gained credit in Level 2, falling short of Level 3 often due to having less effective explanations for local effects, while still giving clear explanations of the impact of global effects. While many students mentioned local habitat destruction, or lack of food – this was rarely linked with death/extinction of *species* – but instead referred to death/extinction of animals/plants/wildlife which was not sufficient for credit. Most answers, however, gave detailed descriptions of carbon dioxide release either directly, or by combustion and/or decay of peat – linked with the consequences of this on global warming, climate change and habitat destruction.

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Students are strongly encouraged to engage in regular practice with this question type during their studies and revision, paying particular attention to formulating a balanced response that addresses the entirety of the question's scope.

4.7.3.3 Land use

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Question 7 (Standard/high and High demand)

07.1
Almost three quarters of students could identify the median result in Table 3.

07.2
Many students made a good attempt at calculating student B's reaction time, and .only made incorrect attempts to convert seconds to milliseconds.
75% of students scored at least 3 marks. Students were mostly able to substitute values into the equation and work this out correctly to gain mark points 1 and 2 quite easily.
Errors were seen when some used their median value from Question **07.1** rather than the mean from Table 3 when substituting into the equation. Students are reminded to read the question detail carefully. There was a significant number of students who were unable to convert numbers from one unit to another by the necessary factor. As part of their studies, students should regularly practise calculations involving prefixes and powers of ten for orders of magnitude.

07.3
Just under 20% of students were able to describe two ways the investigation could be improved, with a further 40% gaining one of the two marks available. It was clear that many students had completed the investigation, but as in previous years still found it a challenge to articulate their ideas clearly. For bullet point 2 in particular, students gave vague statements such as 'drop from same height' or 'start with ruler between the finger and thumb' which were not credited. A significant number of students incorrectly suggested adding another

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independent variable would improve the investigation, such as giving caffeine or alcohol or introducing a distraction.

07.4
This question was widely attempted, with about half of the students achieving 3 or 4 marks. Students generally identified the eye's function as a receptor and gave the correct sequence of impulse transmission via neurones. A notable error, however, incorrectly placing the receptor in the skin. The optic nerve's role and its connection to the brain were rarely mentioned. However, it was pleasing that many students successfully identified the role of chemicals, often specifying neurotransmitters, in synaptic transmission. For mark point 6, a significant number of responses did not gain the mark due to not giving a location for the specific muscle involved in the response. Similarly, some students mentioned the location of the muscle but did not state that it contracts.