AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.5.4

Role of biotechnology

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**9**
Available paper years	**2008–2020**

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.

4.7.5.4 Role of biotechnology

Answer 01 · Mark scheme

June 2008 | BLY3F | Original Q5 | Legacy

question	answers	extra information	mark
5(a)	heat at 120°C for 30 minutes		1
5(b)	no bacteria near the mould **or** nothing grows near Penicillium **or** gap between bacteria and Penicillium **or** bacteria gone / killed / destroyed near Penicillium		1
5(c)(i)	valid / reliable / representative	**not** 'accurate' ignore 'fair'	1
5(c) (ii)	6		1
5(c) (iii)	2		1
5(c) (iv)	48 to 60		1
5(d)	any **two** from: • temperature / heat / suitable temperature range eg 25–40°C • pressure • (concentration of) oxygen • food / nutrients • ions / correct eg / NH_3 / NH_4^+ / nutrients • wastes / named wastes eg. carbon dioxide / lactic acid	do **not** allow keep cool ignore water / nutrient agar allow nutrients only once	2
Total			**8**

4.7.5.4 Role of biotechnology

Answer 01 · Mark scheme June 2008 | BLY3F | Original Q5 | Legacy

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: June 2008

Answer 02 · Mark scheme January 2009 | BLY3F | Original Q5 | Legacy

The full source mark scheme begins on page 18. Follow original question 5 in that document.

Answer 03 · Mark scheme March 2009 | BLY1BP | Original Q4 | Legacy

Four	**A**	insulin is produced by genetically engineered bacteria	**3**
	B	diabetics inject insulin to control diabetes	**4**
	C	the insulin gene is ‘cut out’ using enzymes	**1**
	D	the insulin gene is transferred into a bacterium	**2**

4.7.5.4 Role of biotechnology

Answer 04 · Mark scheme

June 2009 | BLY3F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	bacteria		1
5(a)(ii)	8		1
5(a)(iii)	4 tonnes		1
5(b)(i)	mycoprotein contains less fat **or** less circulatory problems mycoprotein contains (more) fibre **or** reduces colon cancer	it = mycoprotein fat must be comparative	1 1
5(b)(ii)	beef contains <u>more</u> protein **or** <u>better</u> for growth / making cells / enzymes / antibodies	it = beef must be comparative	1
Total			**6**

4.7.5.4 Role of biotechnology

Answer 04 · Mark scheme

June 2009 | BLY3F | Original Q5 | Legacy

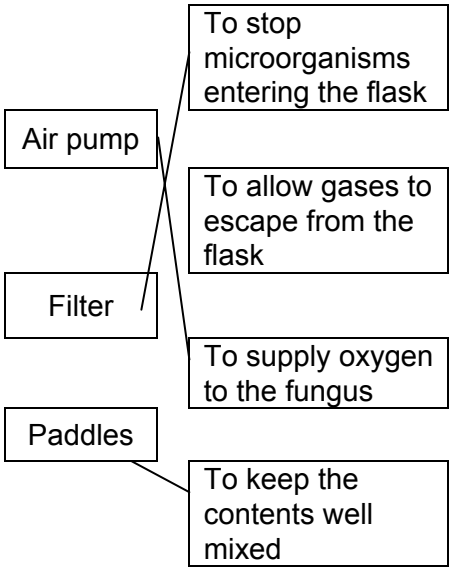
BLY3F

4.7.5.4 Role of biotechnology

Answer 05 · Mark scheme

January 2011 | BLY3F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)		all three correct = **3** marks two correct = **2** marks one correct = **1** mark extra line from a statement cancels the mark	3
6(b)(i)	increased growth **or** increased (dry) mass correct use of numbers eg by 18 (grams) / by 46 times		1 1
6(b)(ii)	glucose supplies energy / materials (for growth) **or** glucose can be used in respiration	ignore glucose provides food	1
6(c)	magnesium		1
6(d)	mycoprotein		1
Total			**8**

4.7.5.4 Role of biotechnology

Answer 05 · Mark scheme

January 2011 | BLY3F | Original Q6 | Legacy

BLY3F

4.7.5.4 Role of biotechnology

Answer 06 · Mark scheme

June 2011 | BLY3F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	cholesterol fat	in this order	1 1
3(a)(ii)	mycoprotein has (approx) half amount of protein / has 11.8 (g) protein while chicken has 22.0 (g)	accept has less protein ignore less fat	1
3(b)(i)	increased (±) constant rate **or** (from 0) to 9.2 / by 9.2(cm) **or** about 1 cm a day **or** increase slower at the beginning and / or at the end		1 1
3(b)(ii)	species **A** grows faster / more than species **B** **or** species **A** has larger diameter **or** is bigger **or** the growth of species **B** slows down after 6 weeks	accept use of approximate figures	1
3(c)	any **two** from: • pH / acidity / alkalinity • (speed of) stirring • oxygen (concentration) / aeration • ion concentration / named eg $-NH_4^+$ • pressure	 ignore references to carbon dioxide / waste products ignore time in the fermenter ignore initial amount of Fusarium allow ammonia	2
Total			**8**

4.7.5.4 Role of biotechnology

Answer 06 · Mark scheme

June 2011 | BLY3F | Original Q3 | Legacy

BLY3F

4.7.5.4 Role of biotechnology

Answer 07 · Mark scheme

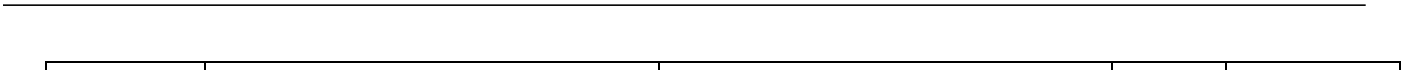
June 2015 | BL3FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	fungus		1	AO1 344d
7(a)(ii)	oxygen / O_2	accept air accept O_2 do **not** allow O^2/ O / O2	1	AO2 344d
7(a)(iii)	glucose (syrup)	allow carbohydrate / sugar ignore food / starch allow oxygen if oxygen / air not given in (a)(ii)	1	AO1 344d
7(b)	any **two** from: • quicker • suitable for vegetarians • cheaper • more efficient **or** less land / methane	ignore high in protein ignore sustainability unqualified ignore less pollution unqualified allow less animals harmed / killed allow food chain is shorter **or** has less trophic levels allow less energy lost (from the food chain) do **not** allow no energy lost allow low(er) in calories (than some meat) allow low(er) in fat / healthier (than some meat) allow source of fibre / prevent constipation	2	AO3 344a/d
Total			**5**	

4.7.5.4 Role of biotechnology

Answer 07 · Mark scheme

June 2015 | BL3FP | Original Q7 | Legacy



4.7.5.4 Role of biotechnology

Answer 08 · Mark scheme

June 2018 | 8461/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	kills microorganisms / bacteria / fungi / viruses / microbes	allow to remove microorganisms / bacteria / fungi / viruses / microbes ignore germs allow so mycoprotein is not contaminated	1	AO2 4.7.5.4
	(which) compete for food / oxygen **or** which make toxins **or** which are pathogens **or** which might kill the fungus / *Fusarium*	allow so mycoprotein is safe to eat	1	
07.2	30 °C		1	AO2 4.1.1.6 4.2.2.1 4.7.5.4
07.3	for (aerobic) respiration	do **not** accept anaerobic	1	AO2 4.4.2.1 4.7.5.4
	(which) releases energy (for growth)	do **not** accept produces energy allow glucose is used to make other organic substances eg protein	1	AO1 4.4.2.1 4.7.5.4

4.7.5.4 Role of biotechnology

Answer 08 · Mark scheme

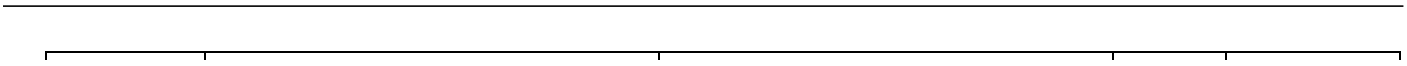
June 2018 | 8461/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	any **two** from: so *Fusarium* can • grow faster / better • get sufficient food / glucose / minerals • get sufficient oxygen • get rid of sufficient carbon dioxide • be kept at a (suitable) temperature	 allow more / enough allow more / enough allow more / enough allow waste allow to avoid 'clumping'	2	AO2 AO3 4.7.5.4
07.5	200 grams		1	AO2 4.7.5.4
Total			**8**	

4.7.5.4 Role of biotechnology

Answer 08 · Mark scheme

June 2018 | 8461/2F | Original Q7



4.7.5.4 Role of biotechnology

Answer 09 · Mark scheme

November 2020 | 8461/2F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	$\frac{6.0}{1.6}$ 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
09.2	$\frac{2.5 - 1.6}{50}$ 0.018 (billion per year)	allow $\frac{0.9}{50}$	1 1	AO2 4.7.3.2
09.3 view with Figure 12	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
09.4	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

4.7.5.4 Role of biotechnology

Answer 09 · Mark scheme

November 2020 | 8461/2F | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.5	**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		

4.7.5.4 Role of biotechnology

Answer 09 · Mark scheme

November 2020 | 8461/2F | Original Q9

09.6	golden rice has improved nutritional value		1	AO1 4.7.5.4
09.7	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**	

Version 1: 0109

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Biology 4411

BLY3F Unit Biology 3

Mark Scheme

2009 examination – January series

4.7.5.4 Role of biotechnology

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

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Dr Michael Cresswell Director General

4.7.5.4 Role of biotechnology

MARK SCHEME

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 and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

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

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 lines 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.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates 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.

4.7.5.4 Role of biotechnology

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

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate 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

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

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 are 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 e.c.f. 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.

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
1(a)(i)	artery		1
1(a)(ii)	capillary		1
1(b)	alveoli		1
	red blood cells		1
	nucleus		1
Total			**5**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
2(a)(i)	energy		1
2(a)(ii)	microorganisms		1
2(b)(i)	25°C		1
2(b)(ii)	pathogens		1
Total			**4**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>3(a)</td><td>178</td><td>ignore working or lack of working

correct working: 180 – 2 but no answer / wrong answer = 1 mark</td><td>2</td></tr>
<tr><td>3(b)</td><td><table><tr><th>Man A</th><th>Man B</th></tr><tr><td>higher</td><td>lower</td></tr><tr><td>lower</td><td>higher</td></tr><tr><td>lower</td><td>higher</td></tr></table></td><td>all 4 cells correct = 2 marks
2 or 3 cells correct = 1 mark
0 or 1 cells correct = 0 mark</td><td>2</td></tr>
<tr><td>Total</td><td></td><td></td><td>4</td></tr>
</table>

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
4(a)	yeast		1
4(b)(i)	**two** sensible suggestions, each linked to correct explanation:	max **4** marks	
	does not release CO		1
	gas is toxic / harms living organisms		1
		allow ethanol <u>only</u> releases CO_2 and H_2O for **1** mark	
	does not release NO_x / SO_2	do **not** allow more pollution / more gases released	1
	gas(es) cause acid rain / eq / harms organisms		1
	or		
	does not cause acid rain (1)		
	(acid rain) damages building / harms organisms (1)		
	made from crops / not a fossil fuel (1)		
	crops can re-grow / source is renewable / fossil fuels are non-renewable (1)		
4(b)(ii)	any **one** from • releases less energy (per litre) • need to burn more to cover same distance / travel shorter distance • land not being used for food crops / less food available • raises food prices		1
Total			**6**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
5(a)	40–60 hours		1
5(b)(i)	decrease 1st slowly then faster / appropriate detail from the graph eg from 7.8 to 0 / faster after 4-10 h		1 1
5(b)(ii)	oxygen after glucose oxygen less than glucose	extra box ticked cancels **1** mark	1 1
5(b)(iii)	aerobic respiration		1
Total			**6**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
6(a)(i)	kill / destroys (micro)organisms / bacteria / fungi / living things	do **not** allow get rid of microorganisms	1
6(a)(ii)	entered from environment / already in flask **or** insufficient heating to kill all microorganisms		1
6(b)	any **two** from: • heated more thoroughly / for longer / higher temperature • destroyed / killed all microorganisms • sealed better eg flask melted / sealed immediately after heating / no pouring through air • microorganisms unable to enter (from air) / can only enter when neck broken / open		2
6(c)	biogenesis		1
Total			**5**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
7(a)(i)	19 800	for correct answer ignore working or lack of working 165 × 120 but no answer / wrong answer = **1** mark (ignore extras)	2
7(a)(ii)	any **two** from: • for respiration • energy released • prevents anaerobic respiration • prevents build-up of lactic acid	 ignore oxygen debt allow energy produced	2
7(b)	any **two** from: • increased breathing rate • increased depth of breathing **or** deep breathing • dilation of arteries / vasodilation • blood diverted from elsewhere	 } more breathing is max **1** mark ignore increase in heart rate allow heavier breathing do **not** allow harder breathing allow blood vessels dilate do **not** allow veins / capillaries dilate ignore name of organ	2
Total			**6**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
8(a)	transpiration / evaporation / diffusion	ignore osmosis	1
8(b)(i)	D		1
8(b)(ii)	any **two** from: • more / faster diffusion **or** evaporation **or** transpiration • molecules move faster • maintains concentration gradient **or** keeps water concentration low in the air **or** brings in more dry air **or** removes damp air / water		2
Total			**4**

4.7.5.4 Role of biotechnology

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
9(a)	prevents denaturation / change / damage of proteins / enzymes **or** prevents bacteria being killed / destroyed	allow protein is 'destroyed' do **not** allow 'bacteria denatured' **or** 'protein killed'	1
9(b)(i)	any **two** from: • anaerobic respiration • lactic (production) • acid (produced)	do **not** allow 'bacteria are acidic' allow max **1** mark if incorrect named acid	2
9(b)(ii)	any **one** from: • thickens / clots / solidifies (milk) • kills other microorganisms **or** prevents other microbes growing • preserves yoghurt **or** prevents yoghurt going off **or** makes yoghurt last longer **or** keeps it fresh • reference to (improved) flavour	allow reference to germs	1
9(c)	reduce / prevent growth / reproduction of microorganisms **or** to prevent decay **or** to preserve it **or** to keep it fresh **or** to prevent it becoming <u>too</u> sour	allow reference to germs ignore curdling	1
Total			**5**

4.7.5.4 Role of biotechnology

Answer 09 · Examiner comments

November 2020 | 8461/2F | Original Q9

Question 9 (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' and a significant number divided this by 5, rather than by 50. Others calculated the mean of the two given values rather than the mean annual increase.

In **09.3** most students attempted to draw some sort of extrapolation on the graph; however, this was often 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. Often this was 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.

Of the more successful students in **09.4** these 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 **09.5** many students did not link 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, hardly any students went beyond 'cutting down trees' and habitat loss. Few students referred to methane production but these rarely went any further. Whilst many students filled up the available space, most of these simply repeated the same vague points in order to do so.

Concluding Remarks

Particular problems which occurred quite frequently included:

- confusion of certain terms, eg mitosis / meiosis, reabsorption / filtration / excretion
- paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response, avoid misconceptions and the inclusion of irrelevant information
- repeating, rather than using, information given in the question, for which no marks are available
- careless reading of the question resulting in an inappropriate answer, or not following instructions in multiple-choice items, such as to tick the correct number of boxes
- careless reading of data from a graph
- omitting numbers when a question asks for the use of data
- missing a question when no answer lines were provided and the answer needed to be in a table or a Punnett square
- poor handwriting, for example with numerals – especially the distinction between the numbers 1 and 2
- not checking whether the answer to a calculation is sensible – for example, in converting units over an appropriate order of magnitude, such as the conversion of nanometres to metres.

Mark Ranges and Award of Grades

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