AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.6

Culturing microorganisms (biology only)

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**20**
Available paper years	**2008–2025**

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.

4.1.1.6 Culturing microorganisms (biology only)

Answer 01 · Mark scheme

January 2008 | BLY3F | Original Q3 | Legacy

The full source mark scheme begins on page 41. Follow original question 3 in that document.

4.1.1.6 Culturing microorganisms (biology only)

Answer 02 · 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**

4.1.1.6 Culturing microorganisms (biology only)

Answer 02 · Mark scheme June 2008 | BLY3F | Original Q5 | Legacy

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: June 2008

Answer 03 · Mark scheme January 2009 | BLY3F | Original Q2 | Legacy

The full source mark scheme begins on page 53. Follow original question 2 in that document.

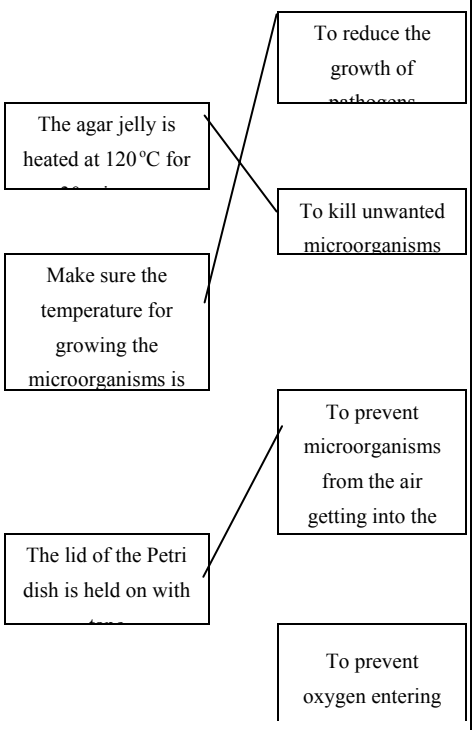
Answer 04 · Mark scheme March 2009 | BLY1AP | Original Q6 | Legacy

Six	**2**	**4**	**4**	**4**

4.1.1.6 Culturing microorganisms (biology only)

Answer 05 · Mark scheme June 2009 | BLY3F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)		**1** mark per correct line each extra line cancels **1** mark	3
3(b)(i)	dish 2 has (colonies of) microorganisms / bacteria / (but there are none in dish 1)	allow fungi / pathogens / microbes / germs allow more microorganisms in dish 2	1
3(b)(ii)	untreated milk contains <u>living</u> microorganisms **or** microorganisms killed by UHT **or** no <u>living</u> microorganisms in UHT milk	ignore microorganisms enter from the air	1

Question 3 continues on the next page…

BLY3F

Question 3 Continued

question	answers	extra information	mark
3(b)(iii)	dish 3 was not opened **or** it was sterilised **or** nothing / no milk was added	do **not** allow no growth of microorganisms because of lack of air / oxygen ignore microorganisms cannot enter from the air	1
Total			**6**

4.1.1.6 Culturing microorganisms (biology only)

Answer 05 · Mark scheme

June 2009 | BLY3F | Original Q3 | Legacy

BLY3F

4.1.1.6 Culturing microorganisms (biology only)

Answer 06 · Mark scheme

January 2010 | BLY3F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	inoculating loop		1
2(a)(ii)	V W	either order	1 1
2(a)(iii)	Z		1
2(b)	carbohydrates		1
Total			**5**

4.1.1.6 Culturing microorganisms (biology only)

Answer 06 · Mark scheme

January 2010 | BLY3F | Original Q2 | Legacy

BLY3F

4.1.1.6 Culturing microorganisms (biology only)

Answer 07 · Mark scheme

January 2010 | BLY3F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	very little of the biogas generator will be seen the temperature inside will not change much	cancel **1** mark for each extra box ticked	1 1
4(b)(i)	methane		1
4(b)(ii)	60	correct answer with or without working 100 – (35 + 1.5 + 1.5 + 2) but incorrect answer allow **1** mark	2
Total			**5**

4.1.1.6 Culturing microorganisms (biology only)

Answer 07 · Mark scheme

January 2010 | BLY3F | Original Q4 | Legacy

BLY3F

Answer 08 · Mark scheme

March 2010 | BLY1AP | Original Q7 | Legacy

Seven	**1**	**3**	**1**	**4**

4.1.1.6 Culturing microorganisms (biology only)

Answer 09 · Mark scheme

January 2011 | BLY3F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)	to kill (other) (micro) organisms (in the milk) / to sterilise	allow germs ignore viruses allow destroy ignore pasteurise	1
8(b)(i)	0.015	award **2** marks for correct answer irrespective of working allow answer or use of 1.5 for **1** mark allow **1** mark for $\frac{(y_1 - y_2)}{100}$ but incorrect answer y-values may be incorrect **or** use of 6.0 **and** 4.5 but incorrect answer	2
8(b)(ii)	running out of substrate / sugar / food **or** (acid / low pH) denatures enzymes / proteins / kills bacteria	accept stops / slows enzymes / metabolism allow (acid / low pH) stops / slows bacteria working / growing	1
8(c)	lactic acid	 if incorrect acid allow **1** mark	1 1
8(d)(i)	25		1
8(d)(ii)	pathogens / harmful bacteria (might) grow (at 35 °C)	do **not** accept viruses	1
Total			**8**

4.1.1.6 Culturing microorganisms (biology only)

Answer 10 · 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**

4.1.1.6 Culturing microorganisms (biology only)

Answer 10 · Mark scheme

June 2011 | BLY3F | Original Q3 | Legacy

BLY3F

4.1.1.6 Culturing microorganisms (biology only)

Answer 11 · Mark scheme

January 2013 | BL1FP | Original Q9 | Legacy

Question 9

question	answers	extra information	mark
9(a)	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.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).	There is a simple description of at least two stages and an explanation of at least one of them.	There is a clear description of all three stages and an explanation of at least two of them.

examples of biology points made in the response:

Pre-inoculation

- Petri dish and agar sterilised before use
- to kill unwanted bacteria
- inoculating loop passed through flame / sterile swab
- to sterilise / kill (other) bacteria

Inoculation

- loop/swab used to spread/streak bacterium onto agar

Allow other correct methods, eg bacterial lawns

- lid of Petri dish opened as little as possible
- to prevent microbes from air entering

Post-inoculation

- sealed with tape
- to prevent microbes from air entering
- incubate
- to allow growth of bacteria

Question 9 continues on the next page

4.1.1.6 Culturing microorganisms (biology only)

Answer 11 · Mark scheme

BL1FP
Question 9 continued

question	answers	extra information	mark
9(b)(i)	bacteria killed / destroyed	ignore fights / attacks / stops growth / got rid of	1
9(b)(ii)	*Might be correct* largest area / space where no bacteria are growing *Might not be correct* (need more evidence as) D may be harmful to people / animals / surfaces **or** may work differently with different bacteria **or** disinfectants may be different concentrations **or** may not last as long	 allow most bacteria killed ignore ref to cost / dangerous or harmful unqualified ignore different amounts of disinfectant unless reference to different drop size ignore take longer to work allow reference to anomalous result or not repeated	 1 1
Total			**9**

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

4.1.1.6 Culturing microorganisms (biology only)

Answer 12 · Mark scheme

June 2013 | BL1FP | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)(i)	25 °C		1
3(a)(ii)	pathogens		1
3(b)	**D** more / most bacteria killed	 accept biggest area / ring where no bacteria are growing	1 1
3(c)	viruses live inside cells		1
Total			**5**

4.1.1.6 Culturing microorganisms (biology only)

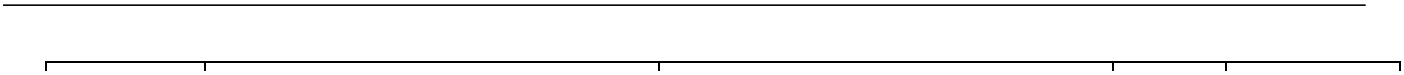
Answer 13 · Mark scheme June 2015 | BL1FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	A (inoculating / wire) loop B Petri dish	 allow (agar) plate ignore ref to culture medium	1 1	AO1 1.1.2m
3(b)(i)	to kill (unwanted) bacteria / microorganisms /microbes	allow fungi ignore viruses / germs	1	AO1 1.1.2m
3(b)(ii)	Using a flame		1	AO1 1.1.2m
3(b)(iii)	any **one** from: • so bacteria / microorganisms / microbes / pathogens / fungi (growing in dish) do not get out • so bacteria / microorganisms / microbes / pathogens / fungi (from the air) do not get in	ignore reference to gases ignore viruses / germs ignore viruses / germs	1	AO1 1.1.2m
3(c)	25 °C		1	AO1 1.1.2 n
Total			**6**	

4.1.1.6 Culturing microorganisms (biology only)

Answer 13 · Mark scheme

June 2015 | BL1FP | Original Q3 | Legacy



4.1.1.6 Culturing microorganisms (biology only)

Answer 14 · Mark scheme June 2017 | BL1FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	**either** Petri dish / culture medium sterile so no other / harmful microorganisms grow **OR** Petri dish / lid secured (with adhesive tape) (1) so microorganisms cannot leave (1) **OR** incubated at 25 °C (1) to prevent / reduce growth of pathogens (1)	reason must be consistent with safety precaution mark together ignore germs ignore other safety precautions do **not** allow viruses allow agar sterile allow so other / harmful microorganisms cannot enter ignore spread unqualified	1 1	AO2 1.1.2m
5(b)(i)	any **one** from: • largest / larger area where no microorganisms are growing • most / more microorganisms killed	allow largest clear / white area	1	AO3 1.1.2h/i/j

4.1.1.6 Culturing microorganisms (biology only)

Answer 14 · Mark scheme

5(b)(ii)	*idea of* E may not be best on all / other (types of) microorganism eg tested on only one type of microorganism	allow antibiotics do not kill viruses allow (other) bacteria / microorganisms may be / become resistant (to E) allow deficiency diseases are not caused by microorganisms allow disease may be minor / not life threatening allow only tested once **or** not repeated allow (patient) may be allergic to E allow idea of investigation not carried out at body temperature	1	AO3 1.1.2h/i/j 1.1.1a
5(c)(i)	B **and** C **and** D	all three required in any order for mark additional letters will cancel the mark	1	AO2 1.1.2

4.1.1.6 Culturing microorganisms (biology only)

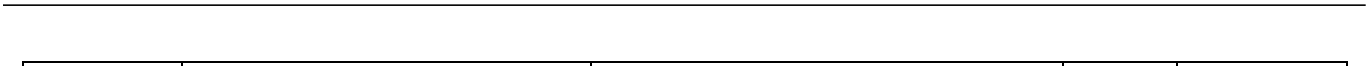
Answer 14 · Mark scheme

5(c)(ii)	Healthy animals will produce a higher yield.		1	AO3 1.1.2
5(c)(iii)	Microorganisms become resistant to the antibiotic.		1	AO1 1.1.2h/i
5(d)(i)	white	allow phagocytes / lymphocytes / leucocytes do **not** allow other types of blood cell	1	AO1 1.1.2c/d
5(d)(ii)	These blood cells produce antibodies. These blood cells ingest pathogens.		1 1	AO1 1.1.2d
Total			**10**	

4.1.1.6 Culturing microorganisms (biology only)

Answer 14 · Mark scheme

June 2017 | BL1FP | Original Q5 | Legacy



4.1.1.6 Culturing microorganisms (biology only)

Answer 15 · Mark scheme

June 2018 | 8461/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	toxins / poisons (secreted by / from / in bacteria)		1	AO1 4.3.1.3
07.2	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
07.3	antibiotics	allow named examples of antibiotics	1	AO1 4.3.1.8
07.4	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

4.1.1.6 Culturing microorganisms (biology only)

Answer 15 · Mark scheme

June 2018 | 8461/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	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
07.6	(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
07.7	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

4.1.1.6 Culturing microorganisms (biology only)

Answer 15 · Mark scheme

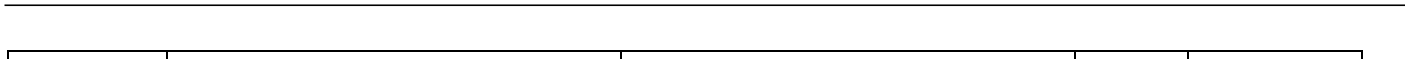
June 2018 | 8461/1F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	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
07.9	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**	

4.1.1.6 Culturing microorganisms (biology only)

Answer 15 · Mark scheme

June 2018 | 8461/1F | Original Q7



4.1.1.6 Culturing microorganisms (biology only)

Answer 16 · Mark scheme June 2019 | 8461/1F | Original Q5

05.1	gonorrhoea		1	4.3.1.3 AO1
05.2	the bacteria are resistant to the antibiotics		1	4.3.1.3 AO2
05.3	abstain from sex(ual intercourse) **or** wash hands after touching penis / urinating / using the toilet	allow abstinence ignore wash hands unqualified	1	4.3.1.1 4.3.1.3 AO2
05.4	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.		4–6	4.1.1.6 AO3 x3 AO2 x3
	Level 1: Relevant features are identified and differences noted.		1–3	
	No relevant content		0	
	Indicative Content: **qualitative statements** • **3** works best on **A** • **1** works best on **B** • **2** works best on **C** • **1** is least effective on **A** • **3** is least effective on **B** • **3** is least effective **or** has no effect on **C** **quantitative statements** • **1** kills more of **B** and **C** compared to **A** • **2** kills more of **C** than **A** / **B** • **3** kills more of **A** than **B** and **C** • **2** kills the same amount of **A** and **B** • **2** and **3** killed similar amounts of **B** • **C** are resistant to **3** • only **2** worked well on all of the bacteria • for **A**, **3** works best, **2** is next and **1** is least effective • for **B**, **1** works best, **2** is next and **3** is least effective • for **C**, **2** works best, **1** is next and **3** is least effective for **level 2** reference to qualitative and quantitative statements is required			

4.1.1.6 Culturing microorganisms (biology only)

Answer 16 · Mark scheme

June 2019 | 8461/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	sample **E**		1	4.1.1.6 AO2
05.6	$\frac{15 + 12 + 13 + 16}{4}$ **or** $\frac{56}{4}$ 14	an answer of 14 scores **2** marks	1 1	4.1.1.6 AO2
05.7	(area = 0.1 × 0.1 =) 0.01 (volume = 0.01 × 0.01 =) 0.0001 (number = $\frac{14}{0.0001}$ =) 140 000	an answer of 140 000 scores **3** marks an incorrect answer for one step does not prevent allocation of marks for subsequent steps allow 1×10^{-2} allow 1×10^{-4} allow ecf from question **05.6** allow 1.4×10^{5} do **not** accept 14×10^{4}	1 1 1	4.1.1.6 AO2
05.8	Q		1	4.1.1.6 AO2
05.9	(bacteria) could make humans ill **or** (bacteria) could kill humans **or** (bacteria) could release toxins	allow reverse argument allow (bacteria) cause infection / disease allow (bacteria) cause appropriately named disease ignore harmful	1	4.3.1.1 AO2
Total			**17**	

4.1.1.6 Culturing microorganisms (biology only)

Answer 16 · Mark scheme

June 2019 | 8461/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.1.1.6 Culturing microorganisms (biology only)

Answer 17 · Mark scheme November 2021 | 8461/1F | Original Q8

08.1	any **two** from: • sterilise equipment / surfaces (before use) • (use) sterilised agar • secure lid of the Petri dish with (adhesive) tape • only lift lid of Petri dish a little (when setting up plate) **or** lift lid of Petri dish at an angle (when setting up plate)	ignore 'clean' unqualified ignore wash hands allow description of how to sterilise equipment allow description of how to sterilise agar	2	AO1 4.1.1.6 RPA2
08.2	B **and** it kills the fewest bacteria **or** it has the smallest area where no bacteria were growing	 allow it has the smallest clear / white area	1	AO3 4.1.1.6 RPA2

4.1.1.6 Culturing microorganisms (biology only)

Answer 17 · Mark scheme

08.3	*(correct measurement)* r = 1.1 (cm) **or** r = 11 (mm) *(recall of the equation)* πr^2 *(calculation/substitution)* 3.14 x 1.1^2 **or** 3.14 x 11^2 = 3.799(4) (from 3.14 x 1.1^2) **or** = 379.9(4) (from 3.14 x 11^2) *correct unit* (3.7994) cm^2 **or** (379.94) mm^2	an incorrect answer for one step does not prevent allocation of marks for subsequent steps ignore calculation and subtraction of filter paper disc area from total area allow d = 2.2 (cm) **or** d = 22 (mm) allow a tolerance of ±1 mm allow correct calculation / substitution using an incorrect measurement allow 3.8 allow 380 do **not** accept unit with no attempt at working / answer	1 1 1 1 1	AO2 4.1.1.6 RPA 2
08.4	any **one** from: • repeat **and** calculate a mean • repeat **and** eliminate anomalies • use a control disc • use different types of bacteria	 allow description of control disc e.g. disc with water / nothing ignore set up a control	1	AO3 4.1.1.6 RPA2
Total			**9**	

4.1.1.6 Culturing microorganisms (biology only)

Answer 17 · Mark scheme

November 2021 | 8461/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.

Answer 18 · Mark scheme

June 2023 | 8461/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	6000 (kJ/m^2/year)		1	AO2 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	$\frac{40}{16\,000} \times 100$ 0.25 (%)		1 1	AO2 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	cows move less indoors it is warmer indoors		1 1	AO1 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	cows are close(r) together	allow cows are in an enclosed space	1	AO2 4.7.5.2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	any **one** from: • D • G • H		1	AO3 4.6.3.7 4.1.1.6 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	DNA		1	AO1 4.6.3.7

4.1.1.6 Culturing microorganisms (biology only)

Answer 18 · Mark scheme

June 2023 | 8461/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7	reproduction		1	AO2 4.6.3.7 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.8	any **two** from: • many animals will become ill • resistant bacteria passed from animal to animal • animals cannot be cured (by the antibiotic) • animals may be less productive / efficient • farmer may lose profit / money	ignore reference to crops allow many animals may die allow disease passed from animal to animal **or** other animals infected allow antibiotic will not work allow less meat / milk produced allow less growth allow cannot sell infected produce / animals	2	AO2 4.3.1.1 4.6.3.7 4.7.5.2

Total Question 4	**11**

4.1.1.6 Culturing microorganisms (biology only)

Answer 19 · Mark scheme

June 2024 | 8461/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	(physical) barrier **or** stops pathogens entering (blood / body)	allow named pathogen throughout allow produces antimicrobial secretions allow produces oil / sebum / sweat ignore reference to scabs / clots	1	AO1 4.3.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	$\frac{63}{210}$ $\frac{3}{10}$	 allow 0.3 ignore 30% if neither mark awarded allow $\frac{210}{63} = \frac{10}{3}$ for **1** mark	1 1	AO2 4.3.1.6 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	*(at pH1)* 187 (killed) *(at pH5)* 31 (killed) (187 – 31) = 156 (more bacteria killed)	ignore negative symbol throughout allow correct subtraction using incorrect calculation at pH1 and/or pH5	1 1 1	AO2 4.3.1.6 4.2.2.1

Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	(the student) calculated the midpoint (between) 23 and 63 **OR** any **two** from: • $\frac{63 - 23}{2} = 20$ • 20 + 23 = 43 • 63 – 20 = 43	 allow (between values at) pH1 and pH3 allow $\frac{23 + 63}{2} = 43$ for **2** marks allow plot data from **Table 1** on graph (1) then read off value for pH2 (1) allow other correct methods for up to **2** marks	1 1	AO3 4.3.1.6 4.2.2.1

Total Question 2	8

4.1.1.6 Culturing microorganisms (biology only)

Answer 20 · Mark scheme

June 2025 | 8461/1F | Original Q4

Question 4

Question	Answers	Mark	AO / Spec Ref.
04.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5-6	AO2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3-4	AO1
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2	AO1 4.1.1.6 RPA2
	No relevant content.	0	

	Indicative content: *preparation of agar plate* • melt agar • pour agar into Petri dish • allow agar to cool / set *transfer of bacteria* • transfer bacteria to agar / Petri dish **or** spread bacteria on agar / Petri dish • transfer bacteria using (inoculating) loop **or** by pouring (liquid) bacterial culture *techniques to ensure sterile conditions (aseptic technique)* • wipe table with a disinfectant / antibacterial solution **or** sanitise hands using sanitiser gel • sterilise agar by heating **or** using autoclave / UV **or** pressure cooker • sterilise Petri dish by heating **or** using autoclave / UV **or** pressure cooker **or** ethanol • sterilise neck of agar / bacteria bottle by passing through a flame • only open lid of agar bottle minimally **or** only lift lid of Petri dish minimally • work next to a Bunsen flame • sterilise inoculating loop before use by dipping in alcohol / ethanol • sterilise inoculating loop before use by passing through a flame *growth of bacteria* • incubate Petri dish upside down • tape lid (correctly) • incubate at 25 °C **or** leave bacteria to grow For **Level 3**, a valid method must include preparation of the agar plate and transfer of the bacteria using sterile techniques. For **Level 2**, a method must include preparation of the agar plate and transfer of the bacteria.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	to prevent growth of pathogens	allow to prevent growth of harmful bacteria / fungi / microorganisms	1	AO2 4.1.1.6 RPA2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	to show the effect of no antibiotics		1	AO2 4.1.1.6 RPA2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4		ignore ring drawn around blank / water disc ignore shading / hatching within rings		AO3 4.1.1.6 RPA2
	larger ring drawn around antibiotic **A** than **B**		1	
	smaller ring drawn around antibiotic **C** than **B**	ignore no ring drawn around antibiotic **C**	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	none of the bacteria would have been killed		1	AO3 4.1.1.6 4.3.1.8

Total Question 4	**11**

Version 1.0: 0108

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Biology 4411

BLY3F Unit 3 Biology

Mark Scheme

2008 examination – January series

4.1.1.6 Culturing microorganisms (biology only)

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Dr Michael Cresswell Director General

4.1.1.6 Culturing microorganisms (biology only)

MARK SCHEME

Information to Examiners

1. General

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- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
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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.

4.1.1.6 Culturing microorganisms (biology only)

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.

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

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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 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 1

question	answers	extra information	mark
(a)	B = rib C = diaphragm		1 1
(b)(i)	D	allow lower case	1
(b)(ii)	carbon dioxide		1
total			4

BLY3F

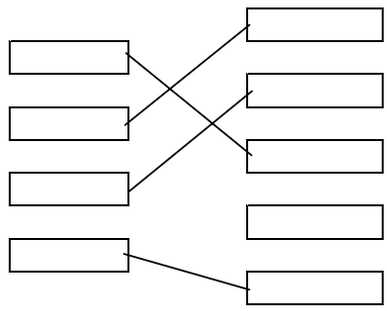
Question 2

question	answers	extra information	mark
(a)(i)	A **or** C	allow lower case	1
(a)(ii)	B **or** D	allow lower case	1
(b)(i)	60		1
(b)(ii)	4		1
(c)	red blood cells		1
total			5

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 3

question	answers	extra information	mark
		**1** mark for each line extra line from List A Action cancels the mark	4
total			4

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 4

question	answers	extra information	mark
(a)(i)	<u>on diagram:</u> arrow drawn from cell **X**, through air space and out through stoma above stoma		1
(a)(ii)	transpiration		1
(b)(i)	13 – 15	ignore units	1
(b)(ii)	any **two** from: • warmest / hottest / brightest time of day • water evaporates fastest • stomata open / more open	accept warmer / hotter **or** sun higher in sky	2
total			5

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 5

question	answers	extra information	mark
(a)(i)	increased / thick(er)	allow more / wide(r) / broad	1
(a)(ii)	decreased		1
(b)	1	IGNORE working or lack of working correct figures from table 2.1 and 1.1 but no answer / wrong answer = **1** mark	2
total			4

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 6

question	answers	extra information	mark
(a)(i)	bladder		1
(a)(ii)	glucose protein	extras – CANCEL	1 1
(b)(i)	any **two** from: • kidney functions all the time / not just 3 × 8 h sessions a week • can eat high-protein foods / high salt foods • cheaper • waste of time	allow direct quotation of correct points from the list allow can eat anything	2
(b)(ii)	have to take (immunosuppressant) drugs / consequence of this eg catch infections / may suffer brain damage / possible rejection of kidney **or** become ill more easily **or** risk of brain damage (due to anaesthetic)	allow direct quotation of correct points from the list	1
(c)(i)	urea		1
(c)(ii)	4.2		1
total			8

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 7

question	answers	extra information	mark
(a)	0.62 to 0.64	ignore working or lack of working correct figures from graph 8.4 and 2.2 but no answer / wrong answer gains **1** mark **or** wrong figures from graph subtracted and divided by 10 gains **1** mark **or** answer 0.61 gains **1** mark	2
(b)	(oxygen for) <u>aerobic</u> respiration		1
	<u>more</u> energy available owtte **or** no / less harmful products **or** no ethanol / alcohol	allow more energy produced / created / made allow converse ignore more efficient	1
total			4

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 8

question	answers	extra information	mark
(a)	to kill (micro)organisms / bacteria / named organism **or** to sterilise	allow germs ignore remove / get rid of	1
(a)(ii)	(room temperature is) suitable / best for growth / reproduction of microorganisms **or** suitable / best for enzymes	accept converse allow germs allow grow / culture (at room temperature) ignore not killed / live	1
(a)(iii)	to prevent entry of microorganisms owtte	apply list principle allow germs ignore dust / dirt	1
(b)	yes (no mark) microorganisms / bacteria could (only) enter B **or** microorganisms / bacteria etc cannot enter flask A living organisms / bacteria / etc only develop from pre-existing organisms / bacteria owtte eg 'life from life' **or** reference to reproduction	can be implied allow do not spontaneously generate eg they can only grow if they can get in gains **2** marks	 1 1
total			5

4.1.1.6 Culturing microorganisms (biology only)

BLY3F

Question 9

question	answers	extra information	mark
(a)(i)	methane	apply list principle allow symbols	1
(a)(ii)	<u>anaerobic</u> respiration / (anaerobic) fermentation	ignore decay / decomposition etc	1
(b)(i)	any **two** from: • manure disposed of • gains fertiliser (for crops) • gets (free) fuel **or** cheap supply of energy **or** (free) cooking / heating / lighting • can sell crops at higher price	 allow converse allow not using wood / trees	2
(b)(ii)	<u>in the UK</u> lower temperature **or** not enough heat process is slower **or** enzymes action slower	allow converse arguments for Sri Lanka ignore other factor(s) ignore references to efficiency / 'bacteria working'	 1 1
total			6

Version 1: 0109

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Biology 4411

BLY3F Unit Biology 3

Mark Scheme

2009 examination – January series

4.1.1.6 Culturing microorganisms (biology only)

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4.1.1.6 Culturing microorganisms (biology only)

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4.1.1.6 Culturing microorganisms (biology only)

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

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4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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>

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

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**

4.1.1.6 Culturing microorganisms (biology only)

Answer 18 · Examiner comments

June 2023 | 8461/2F | Original Q4

Question 4

This question was about energy balances for cattle raised indoors and outdoors, and problems caused by the development of antibiotic resistance in bacteria that might cause disease in the cattle.

04.1 This was a simple sum that required selection of appropriate data from Table 3. Although many students used the data correctly, it was clear that many did not read the question or the table headings correctly, as a variety of answers such as '6002' (adding all the values) and '5900' (subtracting, rather than adding) were given instead of the required value: 6000.

Answer 18 · Examiner comments

June 2023 | 8461/2F | Original Q4

04.2 Many students were able to substitute the correct values into the equation, thus gaining the first mark. However, when it came to giving a final answer, it was not uncommon for students to multiply the answer by 100 again, giving an answer of '25%', rather than 0.25%, thus showing a weak understanding of percentages. Fewer than half the students arrived at the correct answer.

04.3 Half the students were able to select both less movement indoors and it being warmer indoors as two reasons why it was more energy efficient to keep cattle indoors.

04.4 This question was generally well done with more than three-quarters of students stating that the cows were 'closer together' indoors and hence diseases would spread more rapidly. The idea of being 'in an enclosed space' was seen occasionally.

04.5 From Figure 7, it was evident to two-thirds of students that the antibiotic discs with no zone of inhibition (either D, G or H) were ones to which the bacterium was resistant.

04.6 The vast majority also understood that a change in a bacterium's DNA (rather than carbohydrate or lipid) was responsible for antibiotic resistance.

04.7 Most students also understood that a change in one bacterium could cause millions more to become resistant due to the bacteria having a high rate of reproduction.

04.8 The fact that antibiotic resistance in bacteria could become a problem to farmers was variously attributed to illness in the farmer's cattle, their productivity decreasing and them not being able to be cured of their illness by antibiotic treatment and hence the farmer's profits being decreased. Some students struggled to be able to express themselves sufficiently clearly in their answers and only one-quarter scored both of the available marks.

4.1.1.6 Culturing microorganisms (biology only)

Answer 19 · Examiner comments June 2024 | 8461/1F | Original Q2

Question 2 (low demand)

02.1 This question specifically asked how the skin protects against pathogens and not how the human body in general is able to defend itself. References to white blood cells, antibodies, mucus and stomach acid were therefore, not creditworthy. Some students made incorrect suggestions such as 'the hairs on the skin catch pathogens' or 'the pores are small so that pathogens cannot pass through them'. Others used descriptions that lacked specificity such as 'it has many layers' or 'it is thick and strong'. Nearly 60% of students gave the correct idea of the skin being a barrier or stopping pathogens from entering.

02.2 Just over 40% of students were awarded full marks in this question, with nearly 60% gaining the first marking point for a correct fraction but an incorrect simplification. A number of students found the fraction that killed rather than the fraction surviving, and therefore gained no credit.

02.3 Nearly 73% of students gained full marks in this question, and most made good use of the scaffolding provided. A number of students missed out on the third marking point due to not accurately copying their answer from parts 1 and/or 2 correctly and to complete the correct subtraction.

02.4 Students' ability to express themselves clearly, frequently limited their access to the marks available in this question. As a result, just under 27% of students achieved both marks. Some students found explanations difficult and gave answers that lacked clarity, such as 'it just fitted the pattern'. A frequent confused use of mean, mode, median and average was also seen.

Answer 20 · Examiner comments June 2025 | 8461/1F | Original Q4

Question 4 (low and standard demand)

04.1 This was a levelled, extended response question based on a required practical. Students were asked to describe a method to grow bacteria on a sterile agar plate. Around 20% of responses were awarded a mark within Level 3, 50% in Level 2 and 15% in Level 1. Students achieving Level 1 gave one or more appropriate points from the indicative content, but these were insufficient to allow a valid outcome to their method.

Answer 20 · Examiner comments June 2025 | 8461/1F | Original Q4

To enter Level 2, students had to make clear how an agar plate could be prepared to grow a sample of bacteria. This was the minimum requirement to match the Level 2 descriptor of 'identifying most steps in the method'.
To enter Level 3, students had to go further and give examples of aseptic techniques; by doing this, they were able to fulfil the other requirements of the question, including preparing a plate that was 'sterile' and growing a sample of 'uncontaminated' bacteria. Those students who matched the Level 3 criteria generally showed excellent knowledge and understanding of the steps involved. Their descriptions were detailed and appropriately sequenced. The responses of many students, however, remained in Level 2. They appreciated the fundamental steps of preparing and inoculating a plate but struggled to give clear mention of the aseptic techniques that should be followed. Reference to heating the inoculating loop (or some other, identifiable, description) was frequently seen but, without further points, Level 3 was not achievable. Other indicative content was often hinted at but was too vague to be considered. So, answers such as 'other bacteria from the air should be prevented from entering the plate', 'the rod should be sterilised' or 'the bench should be cleaned' were all insufficient as they did not describe how these steps should actually be carried out.

Fewer answers remained in Level 1 and those that did were either very limited in content or made confused comments such as using the Bunsen burner to heat the plate after bacteria had been added. The statements students make in these extended response questions do not need to be long or complex and it is never necessary to include all the points listed in the indicative content on the mark scheme to achieve the highest level. Neither do responses have to be written in complete sentences - succinct bullet points often suffice and may even help students to organise their ideas more effectively. As is always the case with extended response questions, however, answers are considered holistically and always in a positive framework. It was pleasing here to see some students entering Level 3 and achieving high marks.

04.2 Few students (just under 10%) gave a correct answer to this question. The reference to temperature triggered lines of thought which were inappropriate and gained no credit such as:

- a higher temperature could lead to faster growth of bacteria and this could be dangerous.
- a higher temperature might be too high and cause the bacteria to be killed / enzymes to be denatured / the antibiotics not to work.
- a higher temperature might cause the agar to melt.

Answers which suggested that the higher temperature might cause the bacteria to 'become' dangerous were also not creditworthy.

04.3 65% of students were able to identify the purpose of the control disc in the investigation.

04.4 Some students struggled to appreciate that the *difference* in the effectiveness of each antibiotic had to be reflected in their answers and simply drew rings, as requested, around A and C but without any distinctions at all. Others gave a smaller ring around A

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but a larger one around C. Many, however, clearly understood this RPA and gave clear and correct answers. Students should be encouraged to use a pencil, at least in the first instance, when answering questions involving drawing. Answers often showed that students had changed their minds but were unable to erase and correct a first attempt. It was, therefore, difficult for examiners to appreciate their final intentions. Over 11% of students did not attempt this question and students are encouraged to check that all questions have been answered, particularly where no answer lines are provided.