OCR
Oxford Cambridge and RSA

GCE

Biology A

Unit **H020/02:** Depth in biology

Advanced Subsidiary GCE

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
DO NOT CREDIT	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ACCEPT	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Marking Annotations

Annotation	Use
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	Level 3 answer in Level of Response question

Question			Answer	Marks	Guidance
1	(a)	(i)	*two from* ***(a)** because* 1 lung(s) are **,** deflated / less inflated / small(er) / volume decreased ✓ 2 diaphragm is **,** domed / curved up / arched / not flat / relaxed ✓ 3 rib cage is / ribs are **,** in lowered position / not raised ✓	**2**	**Only credit answers that refer to (a) as the chosen option** **DO NOT CREDIT** if the 'a' is not clear enough **Indicate that (a) has been chosen by using the green dot** ● 1 **ACCEPT** 'thorax has smaller volume' **IGNORE** ref to chest volume 2 **ACCEPT** higher / moves up **IGNORE** pushed up 3 **ACCEPT** **'**rib cage moves down' **IGNORE** ref to intercostal muscles
1	(a)	(ii)	it does not use muscle contraction / muscles (just) relax **or** rib cage **,** falls / drops (due to gravity) **or** lungs (elastic so) will recoil ✓	**1**	**IGNORE** ref to energy / ATP **IGNORE** ref to pressure **,** changes / gradients **IGNORE** ref to intercostal muscles contracting during expiration as Q refers to a passive process **ACCEPT** 'diaphragm relaxes' **IGNORE** 'rib cage moves down' as this could involve muscle contraction

Question			Answer	Marks	Guidance
1	(a)	(iii)	*two from* (*as lumen of airways decrease*) 1 reduction in (lumen) diameter of **,** bronchi / bronchioles ✓ 2 harder to exhale / more resistance to exhalation / less air can be exhaled ✓ 3 more air remains in the lungs ✓ 4 harder to inhale / more resistance to inhalation / less air can be inhaled ✓ 5 harder to ventilate / more resistance to ventilation / increased breathing rate / gasping ✓	**2**	**IGNORE** ref to contraction of muscle (as in Q) 1 **ACCEPT** ref to 'narrowing' for 'reduced diameter' **IGNORE** ref to blocking / size **DO NOT CREDIT** ref to trachea 2 **ACCEPT** ref to 'breathing out' for 'exhale' **IGNORE** ref to air leaving / air moving out 4 **ACCEPT** ref to 'breathing in' for 'inhale' **IGNORE** ref to air entering / air moving in 5 **IGNORE** 'hard to breathe' 'struggles to get breath' 'short of breath' wheezing ventilation rate

Question			Answer	Marks	Guidance
1	(b)	(i)	**H** ✓ **D** ✓ **F** ✓ **C** ✓	4	**Mark the first answer in each cell.** If an additional answer is given that is incorrect then = **0 marks** **IGNORE** correct combinations of letters that correspond to D (e.g. A + F + G + H) **IGNORE** correct combinations of letters that correspond to C (e.g. A + F + G or B + G)
1	(b)	(ii)	1 breathe in as deeply as possible / AW ✓ 2 (and) then force as much air out as possible ✓	2	**IGNORE** ref to using nose clip If they have the deepest breath out before the deepest breath in, then **max 1** (for correct mp 2) 1 e.g. 'breathe in as much as possible' 'inhale as much as you can' 'inhale to maximum' 'breathe in all the air that you can' 2 e.g. 'breathe out as hard as possible' 'exhale as much as you can' 'exhale to maximum' 'breathe out all the air that you can' **DO NOT CREDIT** *all* of the air pushed out of lungs
			Total	11	

Question			Answer	Marks	Guidance
2	(a)		<table><tr><th></th><th>mitosis</th><th>meiosis</th></tr><tr><td>A</td><td></td><td>✓</td></tr><tr><td>B</td><td>✓</td><td></td></tr><tr><td>C</td><td>✓</td><td></td></tr></table> ✓ ✓ <table><tr><th></th><th>mitosis</th><th>meiosis</th></tr><tr><td>D</td><td>✓</td><td></td></tr><tr><td>E</td><td></td><td>✓</td></tr></table> ✓	3	**Only credit 1 tick on each row.** **IGNORE crosses** **A ALLOW** a tick for mitosis instead of meiosis **Mark A, B & C together to max 2** 3 correct answers = 2 marks 2 correct answers = 1 mark 1 or 0 correct answers = 0 marks 1 ✗ = max 1 2 ✗ = 0 marks **Mark D & E together to max 1** 2 correct answers = 1 mark 1 or 0 correct answers = 0 marks 1 ✗ = 0 marks
2	(b)	(i)	G_1 **and** S **and** G_2 ✓	1	in any order **IGNORE** G_0, X, Y & Z **DO NOT CREDIT** if M or C are included
2	(b)	(ii)	*idea that* (checking that) DNA has replicated correctly ✓	1	replicate = duplicate = copy **ACCEPT** (checking that) the chromosomes have duplicated correctly **ACCEPT** (checking that) the duplicated chromatids have no faults **ACCEPT** (checking) for **,** mutations / damage to DNA / damage to genes / errors in DNA **IGNORE** genetic material / genetic information **IGNORE** ref to organelle replication

Question			Answer	Marks	Guidance
2	(c)	(i)	**Q** ✓	**1**	**If an additional incorrect answer is given = 0 marks**
2	(c)	(ii)	1 it / P **,** needs to synthesise / contains / has **,** more DNA / longer DNA / more genetic material / more chromosomes ✓ 2 AVP ✓	**1**	1 **CREDIT** ref to P being polyploid **CREDIT** ref to P being diploid and Q being haploid **ACCEPT** *idea of* has more DNA to repair after G_1 checkpoint 2 e.g. ref to P being from an organism at a lower temperature P has a lower metabolic rate **ora** **IGNORE** replicating organelles
2	(c)	(iii)	*two from* 1 it spends all of its time in / does not leave **,** $\underline{G_1}$ **or** it spends all of its time in / does not leave **,** $\underline{G_0}$ ✓ 2 (so) it is not **,** dividing / replicating / undergoing mitosis ✓ 3 specialised / differentiated ✓ 4 AVP ✓	**2**	1 **DO NOT CREDIT** *most of the time* in **,** G_1 / G_0 **ACCEPT** 'has been sent into G_0' **IGNORE** 'is in G_1' as this restates what is in the table **IGNORE** ref to interphase 3 **ACCEPT** ref to having reached the end of its development 4 e.g. of differentiated cell – erythrocyte / neurone / B memory cell etc damage has been detected in G_1 (so cannot progress) is dormant nutrients / size **,** not right to enter growth phase **IGNORE** is a stem cell / cancer / dead / apoptosis

Question			Answer	Marks	Guidance
2	(d)	(i)	***W** / it , has* (many) more cells in prophase **and** (far) fewer cells in telophase ✓	1	**CREDIT** correct ref to the relative numbers of cells in <u>both</u> phases **CREDIT** stated correctly calculated differences e.g. 'W has 20 more cells in prophase and 23 less in telophase' 'W has 20 more cells in prophase and V has 23 more cells in telophase' 'a difference of 20 in prophase and 23 in telophase' **ACCEPT** answers referring to speed rather than no. of cells (i.e. W spends longer in prophase but less time in telophase etc) **DO NOT CREDIT** if Metaphase and/or Anaphase are suggested
2	(d)	(ii)	t-test compares two (or more) means **or** *idea that* this data does not include mean(s) **or** cannot calculate mean from this data **or** cannot calculate SD from this data ✓	1	**CREDIT** ref to not being a normal distribution / is not continuous data / is discrete data **ACCEPT** the idea that there are more than 2 categories **IGNORE** ref to 'average' instead of 'mean'

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(e)</td><td>(i)</td><td>calculation
χ^2 = 13.835 or 13.833 or 13.834 ✓ ✓ ✓</td><td>3</td><td>Correct value of χ^2 = 3 marks
Answer should be to 3 dp to be consistent with the rest of the table. If answer unrounded or over-rounded but otherwise correct, max 2

<table>
<tr><th>Cells</th><th>O</th><th>E</th><th>(O – E)</th><th>(O – E)^2</th><th>$\frac{(O-E)^2}{E}$</th></tr>
<tr><td>In prophase</td><td>85</td><td>65</td><td>20</td><td>400</td><td>6.154</td></tr>
<tr><td>In metaphase</td><td>59</td><td>55</td><td>4</td><td>16</td><td>0.291</td></tr>
<tr><td>In anaphase</td><td>6</td><td>7</td><td>-1</td><td>1</td><td>0.143</td></tr>
<tr><td>In telophase</td><td>50</td><td>73</td><td>- 23</td><td>529</td><td>7.247</td></tr>
<tr><td>Total</td><td>200</td><td>200</td><td></td><td></td><td>13.835</td></tr>
</table>

Award 1 mark per <u>correct</u> row
(whether rounded or not)
plus 1 mark for χ^2

Only penalise the same type of error once.
ALLOW ecf for χ^2 from incorrect row value(s)</td></tr>
<tr><td>2</td><td>(e)</td><td>(ii)</td><td><u>3</u> (degrees of freedom) ✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
2	(e)	(iii)	**Any statement(s) made must be correct for the candidate's responses to (i) <u>and</u> (ii).** *two from* 1 calculated value is **,** > / greater than **,** 7.82 / the critical value at p = 0.05 / the value for (p =) 0.05 **or** 7.82 / the critical value at p = 0.05 / the value for (p =) 0.05 **,** is **,** less than / < **,** 13.835 ✓ 2 (difference / deviation) is **,** significant / not due to chance ✓ 3 95% certain that the results are not due to chance **or** difference would only occur by chance 5% of the time ✓ 4 (difference / deviation) also significant at p = 0.01 value **or** 99% certain that the results are not due to chance **or** difference would only occur by chance 1% of the time **or** value is **,** > / greater than **,** p = 0.01 / 11.35 **or** probability is **,** < / less than **,** 0.01 **or** probability is between 0.01 and 0.001 **or** probability is not significant at p = 0.001 ✓ 5 the <u>null</u> hypothesis can be rejected ✓	**2**	**ALLOW** ecf from candidate's calculated χ^2 value in **(i)** using the number of degrees of freedom they stated in **(ii)**. For incorrect χ^2 and degrees of freedom values, apply mark points 1 to 5 to correspond to their results.
			Total	**17**	

Degrees of freedom	Probability (p)				
	0.99	0.95	0.05	0.01	0.001
1	0.00	0.00	3.84	6.64	10.83
2	0.02	0.10	5.99	9.21	13.82
3	0.11	0.35	7.82	11.35	16.27
4	0.30	0.71	9.49	13.28	18.47
5	0.55	1.15	11.07	15.09	20.52
6	0.84	1.64	12.59	16.81	22.46
7	1.24	2.17	14.07	18.48	24.32

Question			Answer	Marks	Guidance
3	(a)	(i)	it contains **,** N / nitrogen **or** monosaccharide does not contain nitrogen ✓	1	**CREDIT** any correct ref to the nitrogen-containing group in Fig. 3.1 $NHCOCH_3$ **ACCEPT** 'OH is replaced with $NHCOCH_3$' **or** **'**$NHCOCH_3$ is replaced with OH' **ACCEPT** ref to H not being twice C / 15 H instead of 12 / 8 C instead of 6 **ACCEPT** has no OH on carbon 2 **ACCEPT** **'**monosaccharide **only** contains C, H & O' **DO NOT CREDIT** 'it has a nitrogen molecule'
3	(a)	(ii)	beta / β ✓ glucose ✓	2	**IGNORE** alpha / α **DO NOT CREDIT** B / b / beta pleated sheet
3	(a)	(iii)	*four from* 1 (in chitin glycosidic bond(s) formed by) condensation ✓ 2 (molecule of) H_2O / water **,** produced / released ✓ 3 alternate monomers are , upside-down / flipped / rotated through 180^o ✓ 4 because of the position of the **,** OH / H **,** on carbon 1 ✓ 5 forms a **,** straight / linear / unbranched **,** chain / molecule / polymer ✓ 6 similar to cellulose ✓	4	**IGNORE** ref to 1-4 linkage & glycosidic (as given in Q) **ACCEPT** shown on a diagram 3 **ACCEPT** sugars / units / residues / molecules **DO NOT CREDIT** glucose 4 Must be a clear statement **ACCEPT** the 2 OH groups cannot **,** line up / bond 5 **IGNORE** ref to branching **IGNORE** ref to polysaccharide 6 **ACCEPT** ref to H bonds crosslinking between **,** molecules / chains

Question			Answer	Marks	Guidance
3	(b)	(i)	support **or** prevents the trachea(e) from collapsing / keeps the airways open ✓	1	**IGNORE** protection / structure / shape / squashed / strength / stability
3	(b)	(ii)	*idea that* (their presence) restricts the airflow in the trachea / blocks the airways **or** (leakage of haemolymph) deprives the **,** tissues / cells **,** of **,** oxygen / O_2 / nutrients **or** use of **,** oxygen / O_2 / nutrients **,** by mites **or** disease transmission **or** (mites) release toxins ✓	1	**IGNORE** statements that simply refer to the mites feeding on the haemolymph (as given in Q) **ACCEPT** causes the trachea to collapse **IGNORE** 'affects airflow' unqualified **IGNORE** ref to 'difficult to breathe' **ACCEPT** ref to inflammatory / immune **,** response
			Total	9	

Question			Answer	Marks	Guidance
4	(a)	(i)	*Amanita* ✓	1	First letter must be a capital, the rest must be lower case.
4	(a)	(ii)	*one from* 1 (starch) digestion in the regions where the **,** fungus / hyphae **,** not present ✓ 2 *enzymes / they **,** are* released ***/*** diffuse away **,** from the fungus **or** extracellular / secreted ✓	1	1 **ACCEPT** breaks down (starch) in the **,** region / area / agar **,** around the fungus
4	(b)	(i)	*one from* pH / it **,** is **,** the dependent variable / being measured ✓ (pH changes as) fatty acids are produced ✓	1	**ACCEPT** pH (change) indicates the rate of the reaction if pH were controlled there would be no **,** colour change / end point indicated because the pH (change) shows that the **,** reaction is happening / lipid is being broken down **IGNORE** we are investigating pH / pH is being investigated

Question			Answer	Marks	Guidance
4	(b)	(ii)	<u>volume</u> of **,** alkaline / (alkaline) lipid / substrate **,** <u>solution</u> **or** concentration of **,** lipase / enzyme **,** <u>solution</u> **or** <u>volume</u> of **,** lipase / enzyme **,** <u>solution</u> **or** <u>temperature</u> **or** time / intervals **,** between testing of samples ✓	**1**	**Mark 1st answer** **IGNORE** amount **IGNORE** 5 cm^3 - this is how the variable was controlled 'volume of 5 cm^3 of alkaline solution' = 1 mark '5 cm^3 of alkaline solution' = 0 marks **IGNORE** 0.5 % - this is how the variable was controlled 'concentration of 0.5% enzyme solution' = 1 mark '0.5% enzyme solution' = 0 marks **IGNORE** 1 cm^3 - this is how the variable was controlled 'volume of 1 cm^3 of lipase solution' = 1 mark '1 cm^3 of lipase solution' = 0 marks **IGNORE** 20^oC - this is how the variable was controlled 'a temperature of 20^oC' = 1 mark 'keep it at 20^oC' = 0 marks **IGNORE** 30 seconds - this is how the variable was controlled 'the times the samples were taken were at intervals of 30 seconds' = 1 mark 'samples taken every 30 seconds' = 0 marks

Question			Answer	Marks	Guidance
4	(b)	(iii)	concentration of **,** alkaline / (alkaline) lipid / substrate **,** solution **or** volume of indicator (added) **or** number of drops of indicator (added) **or** volume of **,** sample / mixture / solution (removed) **or** number of drops of **,** sample / mixture / solution (removed) ✓	1	**Mark 1st answer** **IGNORE** amount **IGNORE** size / volume **,** of drops
4	(b)	(iv)	*one from* (looking at **,** a small volume / against a white background) makes it easier to see the colour change ✓ the indicator (if added to test tube) might affect the progress of the enzyme reaction ✓ better temperature control as test tube not taken in and out of water bath ✓ AVP ✓	1	**ACCEPT** provides a contrasting background to see the colour **ACCEPT ora** e.g. harder to see colour change in the test tube
4	(b)	(v)	(the optimum temperature) is between 30^{o}C and 35^{o}C ✓	1	**Must give a range** ^{o}C must be stated once **IGNORE** 35^{o}C alone / 'around 35^{o}C'

Question			Answer	Marks	Guidance
4	(b)	(vi)		4	**Mark the first 2 suggestions seen.** **B mark must relate to the appropriate A mark point**
			1A use more intermediate temperature values ✓		1A e.g. test **,** every 2 °C / at 1 °C intervals use temperatures less than 5°C apart
			1B in the 30°C - 35°C range ✓		1B **CREDIT** a range of 25°C - 40°C Units must be given once
					Note: 'test a range of temperatures between 30°C and 35°C' 'carry out more experiments between 30°C and 35°C' = 2 marks (mps 1 & 2)
			2A take samples at more frequent intervals (than 30 seconds) ✓		2A **ACCEPT** sample more regularly
			2B e.g. every 15 seconds ✓		2B time interval must be experimentally workable, so should be from 10 and less than 30 seconds. **Note:** 'take samples every 15 seconds' = 2 marks (mps 3&4) 'take samples every 5 seconds' = 1 mark (mp 3 only)
			3A use of colorimeter ✓		
			3B colour change would be less **,** subjective / biased ✓		3B obtain a numerical value
			4A use of pH **,** meter / probe / sensor ✓		
			4B obtain a numerical value ✓		

Question	Answer	Marks	Guidance
4 (c)*	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (**Be prepared to recognise and credit unexpected approaches where they show relevance.**)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, **Level 1**, **Level 2** or **Level 3**, **best describes the overall quality of the answer**.* *Then, award the higher or lower mark within the level, according to the **Communication Statement** (shown in italics):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		
	Level 3 (5–6 marks) • Provides a description of the 2 mechanisms of enzyme action • Provides a description of the ways in which high and low temperature affects the reactants and active site. *There is a well-developed line of reasoning which is clear and logically structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.* Awarding at this Level = L3 & 5 ticks ✓✓✓✓✓ Communication = ✓ **or** ✗	**6**	**Use the green dot in the margin to indicate places where good scientific points are made about the 2 models of enzyme action.** **Use a highlight square in the margin to indicate places where good scientific points are made about the effect of temperature.** ***[Indicative scientific points are to be found on the next page.]***

Question	Answer	Marks	Guidance
	Level 2 (3–4 marks) • Describes 1 or both of the mechanisms of enzyme action • Describes some ways in which temperature affects the reactants and/or active site. *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.* Awarding at this Level = L2 & 3 ticks ✓✓✓ Communication = ✓ **or** ✗ --- **Level 1 (1–2 marks)** • **either** Describes some aspects of the mechanism of enzyme action **or** Describes an effect of temperature *The information is communicated with some structure but may include a small amount of irrelevant material and some inappropriate use of scientific language.* Awarding at this Level = L1 & 1 tick ✓ Communication = ✓ **or** ✗ --- **0 marks** No response or no response worthy of credit.		**Indicative scientific points may include but are not limited to:** *enzyme action* **1** enzyme-substrate complex formed **2** enzyme-product complex formed **3** product(s) leave the active site **4** lock and key = shape of substrate and enzyme's active site are complementary and so enzyme is specific **5** induced fit = enzyme active site changes shape to accommodate substrate once substrate binds *effect of temperature* *reactants* **6** increase in temperature increases kinetic energy of molecules **7** results in more successful collisions **8** more enzyme-substrate complexes form **9** decrease in temperature reduces kinetic energy of molecules **10** results in fewer successful collisions **11** fewer enzyme-substrate complexes form *active site* **12** enzymes have an optimum temperature **13** (small) increase in temperature affects the bonds involved in tertiary structure **14** change in shape of active site **15** prevents substrate binding to active site **16** high temperature results in denaturing **17** effects of high temperature are irreversible **18** effects of low temperature are reversible
	Total	**17**	

Question			Answer	Marks	Guidance
5	(a)	(i)	closed ✓	1	**DO NOT CREDIT incorrect additional answers**
5	(a)	(ii)	the fish has a single (circulation) **and** the mammal has a double (circulation) ✓	1	**ACCEPT** descriptions of the circulations, but **both** must be described to be awarded the mark. e.g. deoxygenated and oxygenated blood passes separately through the mammalian heart but only deoxygenated blood through the fish heart in a circuit of the body the blood passes through the heart twice in mammals but once in fish **ACCEPT** single (fish circulatory system) versus a double (mammalian circulatory system) **DO NOT CREDIT** double versus single

Question	Answer	Marks	Guidance
5 (b)*	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (**Be prepared to recognise and credit unexpected approaches where they show relevance.**)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, **Level 1**, **Level 2** or **Level 3**, **best describes the overall quality of the answer**.* *Then, award the higher or lower mark within the level, according to the **Communication Statement** (shown in italics):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		
	Level 3 (5–6 marks) • Describes both frog and mammalian circulations • Gives some detail on the relative effectiveness of the two systems. *There is a well-developed line of reasoning which is clear and logically structured, relates to Figs 5.1 and 5.2 and uses scientific terminology at an appropriate level.* *All the information presented is relevant and forms a continuous narrative.* Awarding at this Level = L3 & 5 ticks ✓✓✓✓✓ Communication = ✓ **or** ✗	**6**	**Use the green dot in the margin to indicate places where good scientific points are made about the 2 circulations.** **Use a highlight square in the margin to indicate places where good scientific points are made about the relative effectiveness.** ***[Indicative scientific points are to be found on the next page.]***

Question	Answer	Marks	Guidance
	Level 2 (3–4 marks) • Describes the mammalian or frog circulation. • Attempts a description of the circulation of the other organism. • Comments on the effectiveness of the two systems. *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.* Awarding at this Level = L2 & 3 ticks ✓ ✓ ✓ Communication = ✓ **or** ✗ --- **Level 1 (1–2 marks)** • **either** Describes the mammalian **or** frog circulation. **or** Comments on the effectiveness of the two circulatory systems. *The information is communicated with some structure but may include a small amount of irrelevant material and some inappropriate use of scientific language.* Awarding at this Level = L1 & 1 tick ✓ Communication = ✓ **or** ✗ --- **0 marks** No response or no response worthy of credit.		**Indicative scientific points may include but are not limited to:** *circulations* **19** both are double circulations **20** blood from mammalian heart transported separately to lungs and body **21** oxygenated and deoxygenated blood never mix **22** blood from frog heart transported to lungs and body together **23** blood going to the body in the frog is **,** partially oxygenated / mixed **24** oxygenated blood only separate when returning from lungs **25** reference to the spiral valve partly separating oxygenated and deoxygenated blood **26** flow of blood through the hearts described **27** ref to differences between structure of frog and mammalian hearts *effectiveness of circulation* **28** both can be considered to be effective **29** frog could be considered to be less effective **30** frog has less oxygen available for the body cells **31** circulation is effective enough for the frog's needs **32** frog has lower metabolic rate **33** frog maintains body temperature by other means **34** frog heart may beat faster (to compensate) **35** frog oxygenates blood at skin / mouth **36** frog circulation may limit its size **37** frog circulation developed from that of tadpole **38** mammalian body cells get maximum available O_2 **39** mammal has higher metabolic rate **40** mammal (uses metabolism to) maintain body temperature
	Total	**8**	

Question			Answer	Marks	Guidance
6	(a)	(i)	*idea that* the third diagram shows that the resistant **,** bacteria / colonies **,** were already present (on the original plate) **or** these (resistant) bacteria on the original plate continued to grow when flooded with penicillin ✓	1	**IGNORE** penicillin will kill them so in order for them to survive the mutation must have already happened **IGNORE** no time for natural selection to take place - as these are explanations and not evidence
6	(a)	(ii)	natural <u>selection</u> ✓	1	**CREDIT** directional <u>selection</u> **IGNORE** evolution / survival of the fittest / binary fission / mutation
6	(b)	(i)	3140 ✓ ✓	2	**Correct answer = 2 marks**, even if no working shown. • If the answer is incorrect or has not been rounded to 3 sig. figs., then **award 1 mark** for seeing **either** $\frac{1652 - 51}{x}$ **or** $\frac{1601}{x}$ where x = any number **or** an unrounded answer (e.g. 3139.2156 or 3139) • If the incorrect peak has been chosen, then **award 1 mark only for a correct answer which is correctly expressed to 3 sig. figs.** Using 1649 the correct answer is 3130 Using 1593 the correct answer is 3020

Question			Answer	Marks	Guidance
6	(b)	(ii)	was lower (in 1993) **or** has increased / is higher (in 2012) ✓ *(in 2012)* 52% or 0.52 ✓	2	**IGNORE** ref to raw data **ACCEPT** 'over 4 x greater in 2012' **ACCEPT** 52.4%

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(b)</td><td>(iii)</td><td>two of
1 (trend is) decrease in (number of) deaths (since 2007) ✓

2 consistent / steady / large / dramatic ,
decrease in (deaths from S. aureus specified as)
MRSA (from 2007) ✓

3 ref to better specific cross-infection control measure
in health care ✓

4 any correct processed data comparing either years or
cause of death using figures from table 6 ✓</td><td>2</td><td>IGNORE raw data quotes

2 idea that non-specified fluctuates
Note ‘a large decrease in the number of deaths from MRSA’ = 2 marks (mps 1 & 2)

3 e.g. isolating MRSA cases /
dress code for health professionals /
hygiene measures / pre operation screening

4 MRSA
e.g. decrease of , 1301 / approx. 260 per year
2012 value is ,
18.3% / approx. 20% / approx. $^1/_5$, of 2007 value
a drop of , 82% / approx. 80% , from 2007 to 2012

total
e.g. decrease of , 1495 / approx. 39 per year
2012 value is ,
27.1% / approx. 25% / approx. $^1/_4$, of 2007 value
a drop of , 73% / approx. 70% / approx. 75%,
from 2007 to 2012

<table>
<tr><th rowspan="2">Year</th><th colspan="2">% death certificates mentioning S. aureus</th><th rowspan="2">Total number of death certificates mentioning S. aureus</th></tr>
<tr><th>S. aureus not specified as resistant</th><th>S. aureus specified as MRSA</th></tr>
<tr><td>2007</td><td>22 or 22.4</td><td>78 or 77.6</td><td>2052</td></tr>
<tr><td>2008</td><td>18</td><td>82</td><td>1500</td></tr>
<tr><td>2009</td><td>38 or 37.7</td><td>62 or 62.3</td><td>1253</td></tr>
<tr><td>2010</td><td>49 or 49.5</td><td>51 or 50.5</td><td>960</td></tr>
<tr><td>2011</td><td>43 or 42.9</td><td>57 or 57.1</td><td>638</td></tr>
<tr><td>2012</td><td>48 or 47.6</td><td>52 or 52.4</td><td>557</td></tr>
</table>
</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

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