

AQA, OCR, Edexcel

A Level

A Level Biology

Maths Answers: Score /81

Name: Maths Skills for A level Biology



Guidance

1. Read each question carefully.
2. Don't spend too long on each question.
3. Attempt every question.
4. Always show your workings.

Revise A Level Biology:

www.MathsMadeEasy.co.uk/a-level-biology-revision/

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1a and 1b

6 (g dm ⁻³);	1	
Correct answer of (-)0.14;; 1 mark for correct difference in concentration (5) divided by 35 / (69 – 64) ÷ 35 / 1 ÷ 7	2	Ignore +/- sign Ignore additional d.p. Accept 0.31(4) for 1 mark if female data used

2.

Choice: (Student's) <i>t</i> -test; Reason for choice: Looking for differences between two means; Explanation: Difference is significant / not due to chance because the P value is 0.04 / is less than 0.05;	3	Reason: Allow comparing contrasting two means Explanation: Assume 'it' means difference Explanation: Reject result / data is significant / not due to chance Explanation: do not accept P value is less than 0.04
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3.

6 000 000 OR 6×10^6 ;;	2	1 mark for 3 000 000 OR 3×10^6 Allow 1 mark for 600 (in 1cm ³ of diluted culture)
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4.

<p>1. (μg because) very little ammonia (in soil);</p> <p>2. (μg because) avoids use of (lots of) decimal places (in their results) / avoids the use of powers of 10 / avoids the use of standard form;</p> <p>3. (g^{-1}) to allow comparisons (between samples);</p>	<p>2 max</p>	<p>2. Accept makes numbers more manageable</p> <p>2. Accept makes easier to plot graph</p>
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5.

<p>Correct answer of 4.92, 2 marks;;</p> <p>If $N(N-1) = 3540$, OR $\sum n(n-1) = 720$, then award 1 mark</p>	<p>2</p>	<p>Accept 4.916/4.917/4.9</p>
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6.

<p>Correct number of times between 13.0/12.96 and 13.9/13.92 scores 2 marks;;</p> <p>One mark if correct sizes in ranges of 150.7nm to 154.4nm/ 0.151μm to 0.154μm and 1953.5nm to 2097.6nm/ 1.954μm to 2.098μm;</p>	<p>2</p>	<p>Both lengths required for 1 mark credit</p> <p>Accept refs to 150/0.15 and 2000/2</p> <p>Ignore number of sig fig</p>
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7.

<p>1. Accept answers in the range 33840 to 34680;</p>	<p>1</p>	
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8.

<p>1. Correct answer of 298000 or 297766 or 297765.59 or 296826 = 2 marks;;</p> <p>2. Incorrect answer but working shows $2000 \times 2.72 = 1$ mark;</p> <p>OR</p> <p>Incorrect answer but working shows $2.72^{0.5 \times 10} / 2.72^5 / e^{0.5 \times 10} = 1$ mark</p>	<p>2</p>	<p>1. Accept: any equivalent answer with appropriate rounding</p> <p>e.g. 2.98×10^5, 29.78×10^4 etc.</p>
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9.

<p>1. Correct answer in range of 4.9×10^{-4} to $4.91 \times 10^{-4} = 2$ marks;;</p> <p>2. Incorrect answer but shows division by 24 = 1 mark</p> <p>OR</p> <p>Incorrect answer but shows a number from 1175 to 1178 (ignore position of decimal point, standard form and any numbers that follow) = 1 mark;</p> <p>OR</p> <p>Incorrect answer but show the number 49 (ignore position of decimal point, standard form and any numbers after 49) = 1 mark;</p>	2	<p>1. Accept any equivalent mathematical representation of this answer</p>
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10.

<p>1. Correct answer of $1.9/1.93 \times 10^{25} = 2$ marks;;</p> <p>2. Incorrect answer but shows 84 = 1 mark</p> <p>OR</p> <p>$28 \times 3 = 1$ mark</p> <p>OR</p> <p>Incorrect answer but shows 672 divided by 8 = 1 mark;</p>	2	<p>1. Accept $2 \times 10^{25} = 2$ marks</p> <p>1. Ignore any numbers after 1.93</p>
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11.

<p>1. Horses because more antivenom/antibodies could be collected (as more blood collected);</p> <p>2. $4550 \text{ (cm}^3\text{)} \div 26 \text{ (cm}^3\text{)}$ (blood collected);</p>	2	<p>2. Accept 175 rabbits needed to (collect the volume of blood from) one horse.</p>
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12.

<p>1. There is a less than 0.05/5% <u>probability</u> that the <u>difference(s)</u> (between observed and expected) occurred by <u>chance</u>;</p> <p>2. Calculated value is greater than critical value so the null hypothesis can be rejected;</p> <p>3. (The scientists can conclude that) the proportion of plants that produce 2n gametes does change from one breeding cycle to the next;</p>	<p>2 max</p>	<p>1. Reject 'results (without reference to difference) occurring by chance'. Overall max 1 with this statement.</p> <p>1. Accept 'there is a greater than 0.95/95% <u>probability</u> that the difference did not occur by <u>chance</u>'.</p> <p>1. and 2. Ignore 'difference is significant'</p> <p>2. Do not accept 'P value' for 'critical value'.</p>
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13.

<p>$1.93 \times 10^{11};;$</p> <p>Allow 1 max for</p> <p>$578/3.0 \times 10^{-9}$</p> <p>1.93×10^x when $x \neq 11$</p> <p>Correct answer with incorrect standard form e.g. 19.3×10^{10}</p>	<p>2</p>	<p>Accept any number of significant figures ≥ 2, if rounding correct (1.926×10^{11}). Same principle applies to one max answers.</p>
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14.

(-) 84.1(%);;	2	Accept (-) 84.15(%) Allow 1 mark for 84 OR $\frac{2.82 \times 10^{-7} - 4.47 \times 10^{-8}}{2.82 \times 10^{-7}}$ OR $\frac{2.37 \times 10^{-7}}{2.82 \times 10^{-7}}$
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15.

C. 550 seconds;	1	
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16.

8.64 x 10 ⁵ ;;	2	Accept 864 000 however expressed, e.g. 864 x 10 ³ Allow one mark for $2^6 = 64$ OR $64 / 2^6 \times (1.35 \times 10^4)$
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17.

<p>4.88×10^{-6} ;;;</p> <p>If answer incorrect</p> <p>EITHER</p> <p>Allow 1 mark for 0.244</p> <p>Allow 1 mark for 1.22×10^{-5}</p> <p>OR</p> <p>Allow 1mark for 12200 / 1.525</p> <p>Allow 1 mark for 0.61</p>	<p>3</p>	<p>Accept 5×10^{-6}</p> <p>Accept correct answer however expressed</p> <p>Max 2 for incorrect final answer</p>
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18.

<p>Two marks for correct answer in range of 1.75 to 1.76032;;</p>	<p>2</p>	<p>Accept for 1 mark, incorrect answer using radius 0.87 / 0.88 / 0.880 / 0.8802 / 0.88015;</p> <p>OR</p> <p>Accept for 1 mark, incorrect answer with correct rearranged equation, e.g.,</p> <p>Radius =</p> $\sqrt{(\text{surface area} \div 4\pi)}$ <p>OR</p> $= \sqrt{9.73 \div 12.56}$ <p>OR</p> $= \sqrt{0.77} / \sqrt{0.774} / \sqrt{0.775}$ <p>OR</p> $r^2 = \text{surface area} \div 4\pi$ <p>OR</p> $r^2 = 9.73 \div 12.56$ <p>OR</p> $r^2 = 0.77 / 0.774 / 0.775$
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19.

<p>3.57 / 3.6 / 3.7 / 3.71 / 3.8 (%);;</p>	<p>2</p>	<p>If the answer includes additional decimal places, award the marks if it would round to a correct answer</p> <p>There are 3 cells in anaphase</p> <p>Accept for 1 mark, 101.25 / 101 (students estimate in minutes)</p> <p>OR</p> <p>3.75 (difference between scientist estimate and student's estimate in minutes)</p> <p>Ignore plus or minus signs</p>
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20.

<p>2×10^{-3} / 2.0×10^{-3} / 2.01×10^{-3};;</p>	<p>2</p>	<p>If the answer includes additional decimal places, award the marks if it would round to a correct answer</p> <p>Accept for 1 mark, correct answer not in standard form 0.002 / 0.00201 / 0.002014;</p> <p>OR</p> <p>Correct calculation using incorrect figure from table (9.2) 0.003 / 0.0031 / 0.00319 / 3×10^{-3} / 3.0×10^{-3} / 3.19×10^{-3} / 3.2×10^{-3}</p> <p>OR</p> <p>Correct calculation with answer expressed as g hr^{-1}, 0.12 / 0.121 / 1.2×10^{-1}</p>
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21.

<p>$3.75 \times 10^9 / 3\,750\,000\,000;;$</p>	<p>2</p>	<p>Accept for 1 mark: $3750\,000 / 3.75 \times 10^6$ (cells per mm^3) OR 3.75×10^{12} (wrong volume conversion) OR 3750 (cells per mm^3 of diluted culture) OR Evidence of using correct dilution conversion and correct volume conversion, i.e., x1000 and x 1000</p>
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22.

<p>$1.8 \times 10^8;;$</p> <p>If correct difference but expressed in non-standard form, award 1 mark;</p>	<p>2</p>	<p>Award 1 mark if answer given as 1.8×10^{-8}</p>
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23.

<p>$32.73 / 32.7 / 32 / 33;;$</p> <p>Award 1 max for either</p> <p>409 (409.2) for difference in volume (but incorrect number of mitochondria);</p> <p>OR</p> <p>Answer of 262 (261.9) (using diameter, rather than radius);</p>	<p>2</p>	
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24.

<p>5.6×10^6 (red blood cells per mm^3);; Award 1 max for one of 2.8×10^4 (standard form but ignoring dilution) OR 5 600 000 (correct but not standard form) OR 5.6×10^5 (failure to use depth of liquid on slide);</p>	2	
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<ol style="list-style-type: none"> 1. (μg because) very little ammonia (in soil); 2. (μg because) avoids use of (lots of) decimal places (in their results) / avoids the use of powers of 10 / avoids the use of standard form; 3. (g^{-1}) to allow comparisons (between samples); 	2 max	<ol style="list-style-type: none"> 2. Accept makes numbers more manageable 2. Accept makes easier to plot graph
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<p>Answer between 4.5 and $4.6 \mu\text{g g}^{-1} \text{day}^{-1}$;; Award 1 mark for correct number but wrong / no units</p>	2	<p>Ignore plus or minus signs Accept 'per gram' AND / OR 'per day'</p>
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25a and 25b.

26.

<p>Value between 20,750 (83mm) and 21,250 (85mm) two marks;; Formula given/used but calculation wrong, award 1 mark</p>	2	<p>Magnification = $\frac{\text{image size}}{\text{Object size}}$ (Large number divided by 4)</p>
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27.

<ol style="list-style-type: none"> 1. Line graph with rate on y axis and days/time in days on x axis and linear scales; 2. Correct units of $\mu\text{g min}^{-1}$/per minute/minute⁻¹ <u>$\times 10^{-3}$</u>; 3. Rates correctly calculated and plotted, with line connecting points/line of best fit and no extrapolation; 	3	<p>Correct answers $\times 10^{-3}$ 1.17, 1.50, 1.83, 2.50, 3.33, 4.00, 4.00 (accept to 1DP)</p> <p>2. Reject m^{-1}</p> <p>2. Reject if put 10^{-3} on axis for each point</p> <p>2. '/' means separating units from what goes before i.e. accept sucrose hydrolysis per min / $\mu\text{g}\times 10^{-3}$</p> <p>3. Do not accept a ruled straight line of best fit</p> <p>Accept y axis starting at 1</p>
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28.

<ol style="list-style-type: none"> 1. Tangent to curve drawn; 2. Value in range of 8 to 11; 	2	<ol style="list-style-type: none"> 1. Tangent drawn at about 10 minutes 2. 1 mark only for correct answer
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29.

<ol style="list-style-type: none"> 1. 10 cm^3 of $10\,000\text{ nmol dm}^{-3}$/ (original) solution; 2. 90 cm^3 of water; 	2	<p>If ratio correct but make wrong volume e.g. 1 litre, award 1 mark</p>
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30.

66.7;	1	
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31.

70;	1	
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32.

$\left(\frac{\text{length of chloroplast}}{\text{length of bar}}\right) \mu\text{m};$	1	
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33.

Add 4.5 cm ³ of (1.0 mol dm ⁻³) solution to 25.5 cm ³ (distilled) water;	2	If incorrect, allow 1 mark for solution to water in a proportion of 0.15:0.85
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34.

28.8 / 29;	2	If incorrect, allow: $\frac{6}{200} \times 960 = 1 \text{ mark}$
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35a and 35b.

4;	1	
2.68(6);	2	If answer incorrect: $\Sigma n(n-1) = 242 = 1 \text{ mark}$ $N(N-1) = 650 = 1 \text{ mark}$

36.

0.975/0.98;	2	If incorrect, 0.26 × 6 / or incorrect numbers divided by 1.6 for 1 mark
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37.

0.32;	2	<p>Correct answer = 2 marks</p> <p>Accept 32% for 1 mark max</p> <p>Incorrect answer but identifying 2pq as heterozygous = 1 mark</p>
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38.

115.2/115.3 (cm ³ minute ⁻¹);	1	
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39.

<p>10 130;</p> <p>Tolerance of ± 1</p>	2	$N = \frac{M \times C}{R} = 1$ mark
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40.

Length of bar in mm $\times 1000$;	1	
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41.

<p>1. Rank all STs in ascending order;</p> <p>2. Find value with same number (of people) above and below;</p>	2	2. Accept find middle value
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