

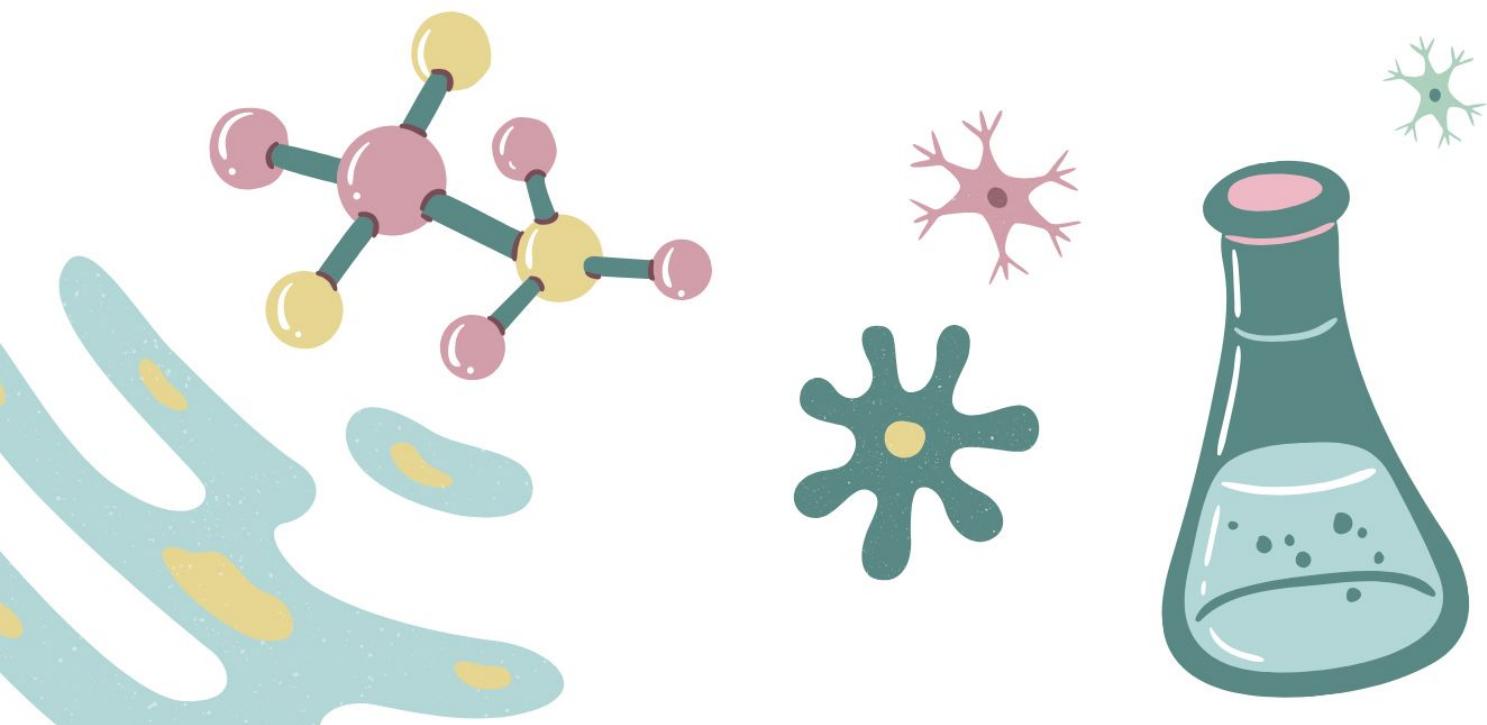


UNIT 4
(SPECIMEN - 2024)

CALCULATIONS SHEET

DR YAHIA ABDELMONEIM
(THE BIOLOGY TEAM)

MARK SCHEME



Q1)

Question number	Answer	Additional guidance	Mark
1(a)(iv)	<ul style="list-style-type: none">calculation of volume of TMV (1)calculation of size difference (1) <p>Example of calculation: $3.14 \times 40 \times 40 \times 300 = 1\ 507\ 200$ 19 / 19.4 / 19.42</p>	Allow ecf Correct answer with no working shown gains full marks	(2)

Q2)

Question number	Answer	Additional guidance	Mark
3(b)(i)	<ul style="list-style-type: none">tangent drawn to curve at 12 00 hours (1)values to calculate gradient given (1)answer with units (1)	Allow ecf Award full marks for correct numerical answer without working	(3)

Q3)

Question number	Answer	Additional guidance	Mark
7(b)(i)	<ul style="list-style-type: none">\log_{10} of 5×10^3 and 1.3×10^5 stated (1)denominator calculated (1)answer (1) <p>Example of calculation: 3.7 and 5.1 $0.301 \times 4 = 1.204$ 1 / 1.2 / 1.16</p>	Allow ecf Award full marks for correct numerical answer without working	(3)

Q4)

Question number	Answer	Mark
8(b)(i)	<ul style="list-style-type: none">calculation of percentage difference <p>Example of calculation: $((106 - 28) \div 28) \times 100 = 279 / 278.6 / 278.57$</p>	(1)

Q5)

Question number	Answer	Mark
1(b)(ii)	<p>D $\text{kJ m}^{-2} \text{yr}^{-1}$</p> <p>The only correct answer is D</p> <p>A is incorrect because it is kJ not kg and should be m^{-2}</p> <p>B is incorrect because it is kJ not kg and should be yr^{-1}</p> <p>C is incorrect because it should be m^{-2}</p>	(1)

Question number	Answer	Additional guidance	Mark
1(b)(iii)	<p>A calculation that shows the following steps:</p> <ul style="list-style-type: none"> percentage of NPP contained in the roots (1) units of NPP calculated (1) <p>OR</p> <ul style="list-style-type: none"> units of NPP in leaves and wood calculated (1) units of NPP in leaves and wood subtracted from 11 700 (1) 	<p>Example of calculation</p> <p>27</p> <p>3159</p> <p>3978 and $4563 / 8541$</p> <p>3159</p> <p>Correct answer with no working gains 2 marks IGNORE any units given</p>	(2)

Q6)

Question number	Answer	Mark
3(b)	<p>B 1.1</p> <p>The only correct answer is B</p> <p>A is incorrect because the data should not be extrapolated from the peaks</p> <p>C is incorrect because the data should not be extrapolated from the troughs</p> <p>D is incorrect because the general trend is increasing not decreasing</p>	(1)

Q7)

Question number	Answer	Additional guidance	Mark
4(a)(i)	<p>A calculation showing the following steps:</p> <ul style="list-style-type: none"> 1% of 47 278 calculated (1) 85.6% calculated and added to 47 278 (1) answer expressed in standard form with between 2 and 5 sig figs (1) 	<p>Example of calculation</p> <p>$1\% = 47\ 278 \div 14.4 = 3283.194$</p> <p>$3283.194 \times 85.6 + 47\ 278 = 328319.4$</p> <p>$3.28 \times 10^5$</p> <p>NB wrong value correctly expressed in standard form = 1 mark</p>	(3)

Q8)

Question number	Answer	Additional guidance	Mark
9(b)	<p>A calculation that shows the following steps:</p> <p>values read from the graph (1)</p> <p>bacteria number divided by yeast number (1)</p>	<p>0.5×10^6 and 12.5×10^6</p> <p>25</p>	(2)

Question number	Answer	Additional guidance	Mark
9(d)	A calculation that shows the following steps: <ul style="list-style-type: none">• numbers substituted into equation (1)• equation rearranged (1)• time given in hours (to a maximum of 3 decimal places) (1)	Example of calculation $0.963 = (7.079 - 3.778) \div 0.301t$ $0.963 \times 0.301 t = 3.301$ 0.289863 t = 3.301 CE if log of logs taken $0.963 \times 0.301t = 11994000$ $11 / 11.4 / 11.39 / 11.388$ (hours) CE if log of logs taken 41378168 hours ACCEPT 11 hours = 660 minutes 11.4 hours = 684 minutes 11.39 hours = 683.4 minutes 11.388 hours = 683.28 minutes	(3)

Q9)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. $10.9 \div 98 / 0.11$ / eq; 2. 8.9 (kDa);	1 ACCEPT correctly rounded value of 0.111224489 2 ACCEPT 8.8 (if 0.11 used)	(2)

Q10)

Question Number	Answer	Additional Guidance	Mark
7(a)	1. $480 - 20 / 460$ (mg); 2. $(460 \div 120 =) 3.8 / 3.83$ (mg);	2 CE from mp 1	(2)

Question Number	Answer	Additional Guidance	Mark
7(b)	1. $5 \times 1000 \div 120 / 41.67$ (mg); 2. $(3.83 \times 100 \div 41.67 =) 9 / 9.19 / 9.2$ (%)	2 CE from 7(a) CE from mp 1 if dp in wrong place	(2)

Q11)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	The correct answer is C 33.3 (g) <i>A is incorrect because 0.03g contains 0.009g curcumin</i> <i>B is incorrect because 3.33g contains 0.1g of curcumin</i> <i>D is incorrect because 33.3 recurring has been rounded incorrectly</i>		(1)

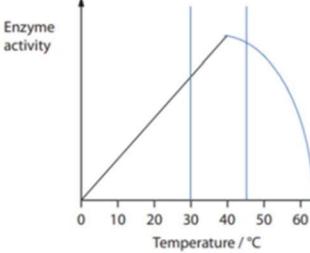
Q12)

Question number	Answer	Additional guidance	Mark
2(c)(iii)	<ul style="list-style-type: none"> accept a value between 9×10^6 and 1.2×10^7 		(1)

Q13)

Question number	Answer	Additional guidance	Mark
7(b)(i)	<ul style="list-style-type: none"> 0.2 (1) 794 / 871 / 873 / 1000 (1) 		(2)
7(b)(ii)	indication of spot positioned between the origin and the 10 000 spot	<p>DO NOT ACCEPT if clearly overlapping</p> <p>CE from 7(b)(i) i.e. if answer in 7(b)(i) is greater than 0.25, the spot would be below the 10 000 spot</p>	(1)

Q14)

Question number	Answer	Additional guidance	Mark
8(a)(i)	<p>An answer that includes the following points:</p> <ul style="list-style-type: none"> linear line that increases with temperature and then decreases (1) optimum temperature shown at (about) 40 °C (1) 	<p>ACCEPT carefully hand-drawn line sloping up to optimum NB line does not have to start at the origin</p> <p>NB optimum must be above 30°C and below 45°C</p> 	(2)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	<ul style="list-style-type: none"> • values at 30 °C and 40 °C chosen (1) • rate calculated per minute for each (1) • numbers substituted into equation (1) • correct answer to 2 / 3 sig figs with no units (1) OR • values at 40 °C and 50 °C chosen • rate calculated per minute for each (1) • numbers substituted into equation (1) • correct answer to 2 / 3 sig figs with no units (1) 	<p>50 and 32.5 and 50 and 22.5</p> <p>$(50-32.5) \div 5 / 17.5 \div 5 / 3.5$ and $(50-22.5) \div 5 / 27.5 \div 5 / 5.5$ CE from reasonable values read from graph</p> <p>$5.5 \div 3.5 / 1.5714$ CE if added 10 to a correct rate from mp 2</p> <p>$1.6 / 1.57$ ACCEPT correctly rounded value for mp 3 OR</p> <p>50 and 22.5 and 50 and 47.5</p> <p>$(50-22.5) \div 5 / 27.5 \div 5 / 5.5$ and $(50-47.5) \div 2.5 / 2.5 \div 5 / 0.5$ CE from reasonable values read from graph</p> <p>$0.5 \div 5.5 / 0.090909$ CE if added 10 to a correct rate from mp 2</p> <p>$0.091 / 0.0909$ ACCEPT correctly rounded value for mp 3</p>	(4)

Question number	Answer	Additional guidance	Mark										
8(b)(i)	<ul style="list-style-type: none"> • mass of monosaccharides calculated to be 1361.3 / correct ratios expressed with more than one dp (1) • ratios shown correctly as either (all) whole numbers or both disaccharide and tetrasaccharide values correctly rounded to one dp (1) 	<p>NB check working out in space and first table for values eg 164.012, 6.868, 1, 1.145</p> <p>disaccharide 6.9 and tetrasaccharide 1.1</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type of carbohydrate</th> <th>Ratio</th> </tr> </thead> <tbody> <tr> <td>monosaccharide</td> <td>164</td> </tr> <tr> <td>disaccharide</td> <td>7</td> </tr> <tr> <td>trisaccharide</td> <td>1</td> </tr> <tr> <td>tetrasaccharide</td> <td>1</td> </tr> </tbody> </table>	Type of carbohydrate	Ratio	monosaccharide	164	disaccharide	7	trisaccharide	1	tetrasaccharide	1	(2)
Type of carbohydrate	Ratio												
monosaccharide	164												
disaccharide	7												
trisaccharide	1												
tetrasaccharide	1												

Q15)

Question number	Answer	Additional guidance	Mark
1(a)(ii)	The only correct answer is C . <i>A</i> is incorrect because $0.7 \times 100 \div 0.3 = 233.3$ <i>B</i> is incorrect because $0.7 \times 100 \div 0.3 = 233.3$ <i>D</i> is incorrect because $0.7 \times 100 \div 0.3 = 233.3$		(1)
Question number	Answer	Additional guidance	Mark
1(b)(ii)	• 2		(1)
Question number	Answer	Additional guidance	Mark
1(b)(iii)	1 : 2.049	ACCEPT 1 : 2.05 / 1 : 2 / 0.488:1 / 0.49:1 / 0.5:1 DO NOT ACCEPT 1 : 2.1	(1)

Q16)

Question number	Answer	Additional guidance	Mark
3(b)	8.42 / 8.4 / 8 (%)		(1)

Q17)

Question number	Answer	Additional guidance	Mark
5(b)(i)	• 0.12 (1) • mm hr ⁻¹ (1)	NB If different units have been used, award a correct numerical value e.g. 0.012 cm hr ⁻¹ = 2 marks	(2)

Q18)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	• 6.1×10^{13} / 61 000 000 000 000 (kg)	ACCEPT 61 trillion / 61 million million	(1)

Q19)

Question number	Answer	Mark
7(a)(i)	<p>The only correct answer is D.</p> <p>A is incorrect because pH is a log scale so the difference of 2 is 100 fold B is incorrect because pH is a log scale so the difference of 2 is 100 fold C is incorrect because there are fewer hydrogen ions at pH 8.5 than pH 6.5</p>	(1) COMP

Question number	Answer	Additional guidance	Mark
7(a)(ii)	650 (%)		(1)

Q20)

Question number	Answer	Additional guidance	Mark
1(a)(iii)	<ul style="list-style-type: none"> • 14 267 / 14 270 / 14 300 / 14 400 / 14 000 (1) 	ACCEPT in standard form e.g. 1.4267×10^4 DO NOT ACCEPT with units	(1)

Q21)

Question number	Answer	Additional guidance	Mark
4(a)(i)	<ul style="list-style-type: none"> • 1.27 / 1.33 (1) 	DO NOT ACCEPT 1.33 recurring	(1)
4(a)(ii)			
4(a)(ii)	<ul style="list-style-type: none"> • 21 / 21.3 / 21.26 / 24.8 / 24.81 / 25 (%) (1) 	Allow ecf from (i)	(1)

Q22)

Question number	Answer	Additional guidance	Mark
5(c)(iv)	<ul style="list-style-type: none"> • MIC of E and G calculated (1) • $\{32 / 2^5\}$ (1) 	MIC of E = 1 in 8 and MIC of G = 1 in 256 Or MIC of E = 1 in 16 and MIC of G = 1 in 512 ACCEPT E is $\{32 / 2^5\}$ times less effective NB correct answer gains 2 marks ACCEPT 2.25 for 1 mark	(2)

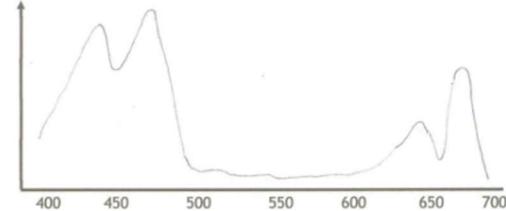
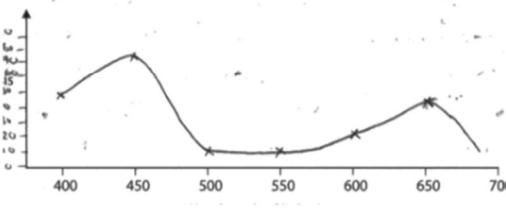
Q23)

Question number	Answer	Additional guidance	Mark
7(a)(i)	7 (g) (1)		(1)
7(a)(ii)	<ul style="list-style-type: none"> value given in the range 0.005 to 0.0083 (1) this value given to 1 or 2 sig figs {per day / day⁻¹} (1) 	ACCEPT answers in correct standard form to 1 or 2 sig figs ACCEPT {0.02 / 0.017} {per day / day ⁻¹ } for 1 mark	(2)

Q24)

Question number	Answer	Additional guidance	Mark
8(b)(i)	<ul style="list-style-type: none"> total biomass of eukarya or all organisms calculated (1) 85.84 / 85.8 / 86 (%) (1) 	468 / 545.2	(2)

Q25)

Question number	Answer	Additional guidance	Mark
2(a)(i)	<p>An answer that includes the following points:</p> <ul style="list-style-type: none"> a line that roughly follows the contours of the absorption spectrum lines and does not drop to zero (1) {left hand peak (if one) / peak at about 460 (if two)} is higher than a right hand {peak / peaks} (1) 	  <p>IGNORE extrapolation back to y axis but if it hits zero then this would negate mp 1</p>	(2)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	<ul style="list-style-type: none"> • $1.2 / 1.23 / 1.24 / 1.25$ 		(1)

Q26)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	<ul style="list-style-type: none"> • length of time calculated for the 35 cycles (1) • 1.38 (hours) (1) 	<p>4950 (seconds) / 82.5 (minutes) / 1.375 (hours)</p> <p>ecf if a given value in {seconds / minutes} is correctly converted into hours with 2 dps</p> <p>Bald answer of $1.38 = 2$ marks</p> <p>Bald answer of 4950 (seconds) / 82.5 (minutes) / 1.375 (hours) = 1 mark</p>	(2)

Q27)

	Answer	Mark
6(b)(i)	<p>The only correct answer is C.</p> <p>A is incorrect because CO_2 is used</p> <p>B is incorrect because CO_2 is used</p> <p>D is incorrect because area is mm^2 and time is hr^{-1}</p>	(1)

Q28)

Question number	Answer	Additional guidance	Mark
7(b)(ii)	<ul style="list-style-type: none"> • 71% of 149 million calculated (1) • farmed area calculated (1) • $5.29 \times 10^7 / 5.3 \times 10^7 (\text{km}^2)$ (1) 	<p>e.g. of calculation</p> <p>105 790 000</p> <p>$(105\ 790\ 000 \div 2) = 52\ 895\ 000$</p> <p>ecf incorrect answer or 105 790 000 expressed in standard form to 1 or 2 dps correctly</p> <p>Bald answer of $5.29 \times 10^7 / 5.3 \times 10^7 (\text{km}^2) = 3$ marks</p> <p>Bald answer of 52 895 000 or incorrect standard form for this value = 2 marks</p> <p>Bald answer of $1.06 \times 10^8 = 2$ marks</p> <p>Bald answer of 105 790 000 = 1 mark</p>	(3)

Q29)

Question number	Answer	Additional guidance	Mark
8(b)(ii)	<ul style="list-style-type: none"> • values read from the graph at 5 and 15 days / a value divided by 240 (1) • 0.08 (1) 	e.g. of calculation 21 to 22 and 3 / in the range of 0.075 to 0.079166 Bald answer of 0.08 = 2 marks Bald answer between 0.075 and 0.079167 rounded up to more than 2 dps = 1 mark	(2)

Q30)

Question number	Answer	Additional guidance	Mark
2(c)(iii)	<ul style="list-style-type: none"> • $\log_{10} N_t$ and $\log_{10} N_0$ values read from graph and subtracted (1) • 2.49 (1) 	6.5 - 2 / 4.5 IGNORE 'log' before the 6.5 and 2 if they clearly haven't used the log value ecf if log of logs have been taken and given to 2 dps = 0.28	(2)

Q31)

Question number	Answer	Mark
5(a)(i)	The only correct answer is C. <i>A is incorrect because m is an area so two dimensional</i> <i>B is incorrect because year is one dimensional</i> <i>D is incorrect because year is one dimensional</i>	(1)
5(a)(ii)	The only correct answer is B. <i>A is incorrect because NPP = GPP - R</i> <i>C is incorrect because NPP = GPP - R</i> <i>D is incorrect because NPP = GPP - R</i>	(1)
Question number	Answer	Additional guidance
5(a)(iii)	<ul style="list-style-type: none"> • 98 : 10 : 1 	ACCEPT 98 : 9.6 : 1 98.3 : 9.6 : 1 100 : 10 : 1 10 : 1 : 0.1 10.3 : 1 : 0.1 1 : 0.1 : 0.01

Q32)

Question number	Answer	Mark
6(a)(iv)	The only correct answer is D. <i>A is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000</i> <i>B is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000</i> <i>C is incorrect because 60mm is 60 000 000 nm, divide this by 120nm = 500 000</i>	(1)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An answer that includes two of the following points: <ul style="list-style-type: none">• two values read from graph, subtracted and divided by 5 (1)• $2 \times 10^5 / 2.0 \times 10^5 / 2.00 \times 10^5$ (1)	$(3.2 - 3.1) \div 5 = 0.02$	(2)

Q33)

Question number	Answer	Additional guidance	Mark
7(a)	<ul style="list-style-type: none">• 83 / 83.0 / 83.3 / 83.33 (%) (1)	DO NOT ACCEPT any other values including recurring numbers e.g. 83.3 IGNORE {decrease / - / ↓}	(1)

Q34)

Question number	Answer	Additional guidance	Mark
8(b)(iii)	<ul style="list-style-type: none">• $700 / 7 \times 10^2$ (times / eruptions) (1)		(1)

Q35)

	Answer	Mark
1(a)	The only correct answer is A \log_{10} number of living bacterial cells <i>B is incorrect because the total cell number plotted would not show the death phase</i> <i>C is incorrect because the exponential phase would not be a straight line</i> <i>D is incorrect because the exponential phase would not be a straight line</i>	(1)

Q36)

4(a)	The only correct answer is A 4524 cm^3 <i>A is incorrect because the answer has been incorrectly rounded</i> <i>C is incorrect because the diameter has been used and the answer incorrectly rounded</i> <i>D is incorrect because the diameter has been used</i>	(1)
Question number	Answer	Additional guidance
4(b)(i)	<ul style="list-style-type: none">• scale worked out as 300 (1)• $750 / 780$ (years) (1)	(2)

Q37)

Question number	Answer	Additional guidance	Mark
5(a)(i)	<ul style="list-style-type: none">• 113		(1)

Question number	Answer	Additional guidance	Mark
5(b)(i)	<ul style="list-style-type: none">• $1.175 (\text{g dm}^{-3})$	ACCEPT 3 / 3.2 / 3.24 (times higher)	(1)

Q38)

Question number	Answer	Additional guidance	Mark
7(d)(iii)	<ul style="list-style-type: none"> mass of Castaneroxy A needed in 1 dm³ calculated (1) mass of leaves needed for 50 000 µg (1) converted into kg and rounded up to 3 (kg) (1) <p>OR</p> <ul style="list-style-type: none"> 50 µg converted into kg (1) mass needed in 1 litre (1) converted into kg and rounded up to 3 (kg) 	50 000 2 631 578 947 0.00000005 0.00005	(3)

Q39)

Question number	Answer	Additional guidance	Mark
9(a)	<ul style="list-style-type: none"> mass of carbon in gt calculated in one year (1) 1.13×10^{13} (kg) (1) <p>OR</p> <ul style="list-style-type: none"> mass in gt converted into mass in kg (1) 1.13×10^{13} (kg) (1) 	11.3 (gt per year) $113 \times 10^{12} / 1.13 \times 10^{14} / 11.3 \times 10^{13}$	(2)

Q40)

Question number	Answer	Mark
1(b)	<p>The only correct answer is C</p> <p>A is incorrect because 10 µg is 0.01 mg, and $0.5 \text{ mg} \div 0.01 = 50$ B is incorrect because 10 µg is 0.01 mg, and $0.5 \text{ mg} \div 0.01 = 50$ D is incorrect because 10 µg is 0.01 mg, and $0.5 \text{ mg} \div 0.01 = 50$</p>	(1)

Q41)

Question number	Answer	Additional guidance	Mark
3(b)(i)	<ul style="list-style-type: none"> 8.7% of the 8.3×10^{12} calculated (1) 7.6×10^{12} (1) <p>OR</p> <ul style="list-style-type: none"> percentage recycled calculated (1) 7.6×10^{12} (1) 	$0.7221 \times 10^{12} / 7.221 \times 10^{11}$ 91.3 Bald answer of $7.6 \times 10^{12} = 2$ marks Bald answer of $7.5779 \times 10^{12} / 76 \times 10^{11} / 0.7221 \times 10^{12} / 7.221 \times 10^{11} / 91.3 = 1$ mark	(2)

Q42)

Question number	Answer	Additional guidance	Mark
4(a)	<ul style="list-style-type: none"> • $5 \{ \text{million} / \times 10^6 \}$ $5 000 000$ $4.8 / 4.9 \{ \text{million} / \times 10^6 \}$ $4 800 000 / 4 900 000$ $4.78 / 4.85 / 4.86 / 4.92 \{ \text{million} / \times 10^6 \}$ $4 780 000 / 4 850 000 / 4 860 000 / 4 920 000$ 		(1)

Q43)

Question number	Answer	Additional guidance	Mark
5(a)(ii)	<ul style="list-style-type: none"> • $33 / 33.3 / 33.33 (\%)$ 		(1)

Q44)

Question number	Answer	Additional guidance	Mark
6(c)(i)	<ul style="list-style-type: none"> • values for 20°C and 30°C read from the graph (1) • numbers substituted into the equation and evaluated (1) • $1.5 / 1.6 / 1.56 / 1.62$ with no units (1) 	$\{2.6 / 2.7 / 2.8\}$ and 4.2 $4.2 \div 2.6 = 1.615384615$ $4.2 \div 2.7 = 1.555555555556$ $4.2 \div 2.8 = 1.5$ answer to 1 or 2 decimal places Bald answer of $1.5 / 1.6 / 1.56 / 1.62$ with no units = 3 marks Bald answer of $1.556 / 1.615$ or more correctly rounded dps = 2 marks Bald answer of $\{2.6 / 2.7 / 2.8\}$ and 4.2 = 1 mark	(3)

Q45)

Question number	Answer	Additional guidance	Mark
9(a)	<ul style="list-style-type: none"> • 1 (children) : 2.7 (women) : 4.7 (men) <p>OR</p> <p>1 (children) : 3 (women) : 5 (men)</p>	ACCEPT $0.4 : 1 : 1.8$ $0.2 : 0.6 : 1$ ACCEPT values in different order if clearly shown which is which	(1)

Q46)

Question number	Answer	Additional guidance	Mark
2(a)(i)	<ul style="list-style-type: none"> • mass of large and small bears calculated (1) • $88 / 88.1 / 88.13 (\text{kg})$ 	133.5294117647 and 45.4 88.1294117647058 Bald correct answer = 2 marks Bald masses = 1 mark Bald unrounded = 1 mark	(2)

Q47)

Question number	Answer	Additional guidance	Mark
5(a)(i)	<ul style="list-style-type: none"> • tangent correctly drawn (1) • rate calculated (1) • rate value between 0.060 and 0.090 expressed to 3 dps max (1) 	<p>line touches the outside of the curve at 1 200 seconds</p> <p>e.g. $65 \div 880 = 0.073863636363$ $50 \div 720 = 0.069444444$</p> <p>ECFs:</p> <p>$147 \div 1120 = 0.1386792$ $147.5 \div 1120 = 0.131696428571$ $148 \div 1120 = 0.13962$ $147 \div 1130 = 0.13725490$ $147.5 \div 1130 = 0.13053097$ $148 \div 1130 = 0.1383177$</p> <p>Ecf values from mp 2 correctly rounded to a max of 3 dps Ecf value of 0.1225 / 0.122916 / 0.12333 correctly rounded to max 3 dps but do not accept recurring numbers</p>	(3)

Q48)

Question number	Answer	Mark
6(b)(i)	<p>The only correct answer is B</p> <p>A is incorrect because the rate = $229 \times 10^6 \div 4.09 \times 10^5 = 559.9 = 600$ C is incorrect because the rate = $229 \times 10^6 \div 4.09 \times 10^5 = 559.9 = 600$ D is incorrect because the rate = $229 \times 10^6 \div 4.09 \times 10^5 = 559.9 = 600$</p>	(1)
6(b)(ii)	<p>The only correct answer is D</p> <p>A is incorrect because $274\,000 : (409\,000 - 274\,000) = 274\,000 : 135\,000 = 2 : 1$ B is incorrect because $274\,000 : (409\,000 - 274\,000) = 274\,000 : 135\,000 = 2 : 1$ C is incorrect because $274\,000 : (409\,000 - 274\,000) = 274\,000 : 135\,000 = 2 : 1$</p>	(1)

Q49)

Question number	Answer	Additional guidance	Mark
7(a)(i)	<ul style="list-style-type: none"> • $16.82 / 16.83 / 16.87 / 16.8 / 16.9 / 17$ (1) 		(1)

Question number	Answer	Additional guidance	Mark
7 (b)(i)	<ul style="list-style-type: none"> • 74 (%) (1) 	DO NOT ACCEPT any other value	(1)
7 (b)(ii)	<ul style="list-style-type: none"> • $1.5 \times 10^{12} / 1.54 \times 10^{12}$ (kg) (1) 		(1)

Q50)

Question number	Answer	Additional guidance	Mark
1(e)	<ul style="list-style-type: none"> • $(0.0085 \text{ cm} =) 85 \text{ } (\mu\text{m})$ (1) • $7.3 \text{ } (\mu\text{m})$ (1) <p>OR</p> <ul style="list-style-type: none"> • length in cm calculated (1) • $7.3 \text{ } (\mu\text{m})$ (1) 	Bald answer of $7.3 = 2$ marks Bald answer of $85 \text{ } (\mu\text{m}) = 1$ mark Bald answer with the values $(7.2649572 / 0.00072649572)$ correctly rounded but not to 2 sig figs = 1 mark Bald answer to 2 sig figs but wrong order of magnitude = 1 mark	(2)

Q51)

Question number	Answer	Additional guidance	Mark
3(a)	<ul style="list-style-type: none"> • 8.5×10^5 (1) 		(1)

Q52)

Question number	Answer	Additional guidance	Mark
4(a)	<ul style="list-style-type: none"> • whole number in range of 55 to 70 (%) (1) 		(1)

Q53)

Question number	Answer	Additional guidance	Mark
5(a)	<ul style="list-style-type: none"> • $3.2 \times 10^7 / 3.18 \times 10^7$ (1) 		(1)

Q54)

Question number	Answer	Additional guidance	Mark
8(a)(i)	An answer that includes the following points: <ul style="list-style-type: none"> • 35 452 and 83 240 (1) • $43 / 42.6 / 42.59$ (%) (1) 	Bald answer of $\{43 / 42.6 / 42.59\}$ = 2 marks Bald answer containing {too many dps / incorrect rounding with acceptable number of dps} = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An answer that includes the following points: <ul style="list-style-type: none"> • (total energy lost to) respiration / heat (energy) (1) • (total energy lost to) $56\ 672 / 56\ 792$ (1) • four arrows each coming out of a different grey box pointing to the vertical RH arrow (1) 		(3)

Q55)

Question number	Answer	Additional guidance	Mark
9(a)(i)	<ul style="list-style-type: none"> • 380 and 210 / 170 / 380 and 215 / 165 (1) • 11.3 (if 210 used) / 11.0 (if 215 used) (1) 	<p>DO NOT ACCEPT 11.00 / 11.30</p> <p>Bald answer of {11.0 / 11.3} = 2 marks Bald answer with incorrect number of sig figs = 1 mark Bald answer of {170 / 165} = 1 mark</p>	(2)

Question number	Answer	Additional guidance	Mark
9(a)(ii)	<ul style="list-style-type: none"> • answer in the range of 468 to 470.7 to max one dp (1) 		(1)

Q56)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	<ul style="list-style-type: none"> • values for R_{20} and R_{10} read from the graph (1) • Q_{10} given as 4 (1) 	<p>6 and {21.5 / 22}</p> <p>DO NOT ACCEPT with units IGNORE a.u.</p> <p>Bald answer of 4 = 2 marks Bald answer between 3.583 and 3.667 = 1 mark</p>	(2)

Q57)

Question number	Answer	Additional guidance	Mark
4(a)(i)	<ul style="list-style-type: none"> {0.29 / 0.3} metres per year metres yr^{-1} m yr^{-1} m per y metres / year (1) 	ACCEPT with or without - sign DO NOT ACCEPT m per yr^{-1} m / yr^{-1} m^{-1}	(1)

Q58)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	<ul style="list-style-type: none"> $1 \times 10^7 / 1.002 \times 10^7$ (1) 	ACCEPT $1 \cdot 10^7 / 1.002 \cdot 10^7$	(1)

Q59)

Question number	Answer	Additional guidance	Mark
7(a)(i)	<ul style="list-style-type: none"> $3500 \text{ nm} / 3.5 \times 10^3 \text{ nm} / 3.5 \mu\text{m}$ (1) 	ACCEPT {3 / 3.3} {× / times} DO NOT ACCEPT correct value with wrong unit 3 / 3.3 with units 3 500 or 3.5 without units	(1)

Q60)

Question number	Answer	Additional guidance	Mark
8(c)(ii)	<ul style="list-style-type: none"> 1258.925412 and 25118.8643 (1) $19.95 / 20$ (x) (1) <p>OR</p> <ul style="list-style-type: none"> $(4.4 - 3.1 =) 1.3$ (1) $19.95 / 20$ (x) (1) 	Bald answer of $19.95 / 20$ (x) = 2 marks Bald answer of 1.3 = 1 mark Bald answer of 23859.9389 rounded correctly = 1 mark Bald answer of 19.9526 = 1 mark	(2)

Q61)

Question number	Answer	Additional guidance	Mark
2(b)	<ul style="list-style-type: none"> • 3.2 (1) • 3 / 2.7 / 2.66 / 2.658 (1) 	ACCEPT $\log 5.2 - \log 2 = 3.2$ ECF 0.3 / 0.34 / 0.345 = 1 mark Bald answer of {3 / 2.7 / 2.66 / 2.658} = 2 marks Bald answer of 2.6578073089700996677 {incorrectly rounded up to three decimal places max / correctly rounded to more than three decimal places} = 1 mark Bald answer of 3.2 = 1 mark Bald answer of {0.3 / 0.34 / 0.345} = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
2(c)(i)	<ul style="list-style-type: none"> • 63 / 63.1 (:1) <p>OR</p> <p>0.02 / 0.016 (:1)</p>		(1)

Q62)

Question number	Answer	Additional guidance	Mark
3(a)	<ul style="list-style-type: none"> • 4.2×10^7 (1) 		(1)

Q63)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	<ul style="list-style-type: none"> • {62 / 63 / 64} and 8 (1) • 0.60 / 0.61 / 0.62 (1) 	Bald answer of 0.60 / 0.61 / 0.62 = 2 marks Bald answer of 0.6 / 0.61111 / 0.62222 = 1 mark	(2)

Q63)

Question number	Answer	Additional guidance	Mark
4(c)(i)	<ul style="list-style-type: none"> • 4 / 4.1 / 4.13 / 4.125 (times) (1) 		(1)

Q64)

Question number	Answer	Mark
6(a)	The only correct answer is A B is incorrect because $(120 - 74) \div 120 = 0.383333333333$ C is incorrect because $(120 - 74) \div 120 = 0.383333333333$ D is incorrect because $(120 - 74) \div 120 = 0.383333333333$	(1)
6(b)(i)	The only correct answer is C A is incorrect because $3200 \div 6.25 = 512$ B is incorrect because $3200 \div 6.25 = 512$ D is incorrect because $3200 \div 6.25 = 512$	(1)

Q65)

Question number	Answer	Additional guidance	Mark
1(b)(i)	<ul style="list-style-type: none"> $1.1 \times 10^5 / 1.13 \times 10^5 / 1.1 \cdot 10^5 / 1.13 \cdot 10^5$ (1) 	ACCEPT 1.10×10^5 DO NOT ACCEPT 1.13×10^5 recurring	(1)
1(b)(ii)	<ul style="list-style-type: none"> 25 (1) 	DO NOT ACCEPT 25.0	(1)
1(b)(iii)	<ul style="list-style-type: none"> $0.02 / 0.016 / 0.0162 / 2 \times 10^{-2} / 1.6 \times 10^{-2} / 1.62 \times 10^{-2}$ (%) (1) 		(1)

Q66)

Question number	Answer	Additional guidance	Mark
3(b)(i)	<ul style="list-style-type: none"> 0.37 (nm) (1) 	3.7×10^{-1}	(1)

Q67)

Question number	Answer	Mark
6(a)(i)	<p>The correct answer is A ($\frac{5}{11}$)</p> <p>B is incorrect because it is $(3.3 - 1.8) \div 3.3 = \frac{5}{11}$</p> <p>C is incorrect because it is $(3.3 - 1.8) \div 3.3 = \frac{5}{11}$</p> <p>D is incorrect because it is $(3.3 - 1.8) \div 3.3 = \frac{5}{11}$</p>	(1)

Q68)

Question number	Answer	Additional guidance	Mark																																																																																																																																															
8(a)	<ul style="list-style-type: none"> (radius calculated) 37 / 25 (1) (radius converted into mm) 0.037 / 0.025 (1) (mm³) expressed to max of 3 sig figures (1) 	<p>ECF if 62 is used</p> <p>ACCEPT standard form ECF for wrong conversion</p> <p>Correct bald answer = 3 marks, but with wrong order of magnitude = 2 marks or too many sig figs = 2 marks, or both order of magnitude and too many sig figs = 1 mark</p> <p>Correct bald answer for d = 62 = 2 marks, but with wrong order of magnitude = 1 mark or too many sig figs = 1 mark</p> <table border="1"> <thead> <tr> <th>D</th> <th>R (μm)</th> <th>R(mm)</th> <th>R3</th> <th>π</th> <th>4 × π × R3</th> <th>+3</th> <th>1 sig fig mp 3</th> <th>2 sig figs mp 3</th> <th>3 sig figs mp 3</th> <th>Stand for</th> </tr> </thead> <tbody> <tr> <td>74</td> <td>37</td> <td>0.037</td> <td>0.000050653</td> <td>3</td> <td>0.000608</td> <td>0.0002026</td> <td>0.0002</td> <td>0.00020</td> <td>0.000203</td> <td>10⁻⁴</td> </tr> <tr> <td>74</td> <td>37</td> <td>0.037</td> <td>0.000050653</td> <td>3.14</td> <td>0.000636</td> <td>0.000212067</td> <td>0.0002</td> <td>0.00021</td> <td>0.000212</td> <td>10⁻⁴</td> </tr> <tr> <td>74</td> <td>37</td> <td>0.037</td> <td>0.000050653</td> <td>3.142</td> <td>0.000637</td> <td>0.000212202</td> <td>0.0002</td> <td>0.00021</td> <td>0.000212</td> <td>10⁻⁴</td> </tr> <tr> <td>74</td> <td>37</td> <td>0.037</td> <td>0.000050653</td> <td>3.141593</td> <td>0.000637</td> <td>0.000212175</td> <td>0.0002</td> <td>0.00021</td> <td>0.000212</td> <td>10⁻⁴</td> </tr> <tr> <td>50</td> <td>25</td> <td>0.025</td> <td>0.000015625</td> <td>3</td> <td>0.000188</td> <td>0.0000625</td> <td>0.00006</td> <td>0.000063</td> <td>0.0000625</td> <td>10⁻⁵</td> </tr> <tr> <td>50</td> <td>25</td> <td>0.025</td> <td>0.000015625</td> <td>3.14</td> <td>0.000196</td> <td>6.54167E-05</td> <td>0.00007</td> <td>0.000065</td> <td>0.0000654</td> <td>10⁻⁵</td> </tr> <tr> <td>50</td> <td>25</td> <td>0.025</td> <td>0.000015625</td> <td>3.142</td> <td>0.000196</td> <td>6.54583E-05</td> <td>0.00007</td> <td>0.000065</td> <td>0.0000655</td> <td>10⁻⁵</td> </tr> <tr> <td>50</td> <td>25</td> <td>0.025</td> <td>0.000015625</td> <td>3.141593</td> <td>0.000196</td> <td>6.54498E-05</td> <td>0.00007</td> <td>0.000065</td> <td>0.0000654</td> <td>10⁻⁵</td> </tr> <tr> <td>62</td> <td></td> <td>0.031</td> <td>0.000029791</td> <td>3</td> <td>0.000357</td> <td>0.000119164</td> <td>0.0001</td> <td>0.00012</td> <td>0.000119</td> <td>10⁻⁴</td> </tr> <tr> <td>62</td> <td></td> <td>0.031</td> <td>0.000029791</td> <td>3.14</td> <td>0.000374</td> <td>0.000124725</td> <td>0.0001</td> <td>0.00012</td> <td>0.000125</td> <td>10⁻⁴</td> </tr> <tr> <td>62</td> <td></td> <td>0.031</td> <td>0.000029791</td> <td>3.142</td> <td>0.000374</td> <td>0.000124804</td> <td>0.0001</td> <td>0.00012</td> <td>0.000125</td> <td>10⁻⁴</td> </tr> <tr> <td>62</td> <td></td> <td>0.031</td> <td>0.000029791</td> <td>3.141593</td> <td>0.000374</td> <td>0.000124788</td> <td>0.0001</td> <td>0.00012</td> <td>0.000125</td> <td>10⁻⁴</td> </tr> </tbody> </table>	D	R (μm)	R(mm)	R3	π	4 × π × R3	+3	1 sig fig mp 3	2 sig figs mp 3	3 sig figs mp 3	Stand for	74	37	0.037	0.000050653	3	0.000608	0.0002026	0.0002	0.00020	0.000203	10 ⁻⁴	74	37	0.037	0.000050653	3.14	0.000636	0.000212067	0.0002	0.00021	0.000212	10 ⁻⁴	74	37	0.037	0.000050653	3.142	0.000637	0.000212202	0.0002	0.00021	0.000212	10 ⁻⁴	74	37	0.037	0.000050653	3.141593	0.000637	0.000212175	0.0002	0.00021	0.000212	10 ⁻⁴	50	25	0.025	0.000015625	3	0.000188	0.0000625	0.00006	0.000063	0.0000625	10 ⁻⁵	50	25	0.025	0.000015625	3.14	0.000196	6.54167E-05	0.00007	0.000065	0.0000654	10 ⁻⁵	50	25	0.025	0.000015625	3.142	0.000196	6.54583E-05	0.00007	0.000065	0.0000655	10 ⁻⁵	50	25	0.025	0.000015625	3.141593	0.000196	6.54498E-05	0.00007	0.000065	0.0000654	10 ⁻⁵	62		0.031	0.000029791	3	0.000357	0.000119164	0.0001	0.00012	0.000119	10 ⁻⁴	62		0.031	0.000029791	3.14	0.000374	0.000124725	0.0001	0.00012	0.000125	10 ⁻⁴	62		0.031	0.000029791	3.142	0.000374	0.000124804	0.0001	0.00012	0.000125	10 ⁻⁴	62		0.031	0.000029791	3.141593	0.000374	0.000124788	0.0001	0.00012	0.000125	10 ⁻⁴	(3)
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8(b)(i)	15 / 15.0	DO NOT ACCEPT any other values	(1)

DR YAHIA ABDELMONEIM