
BIOLOGY

9700/52

Paper 5 Planning, Analysis and Evaluation

May/June 2017

MARK SCHEME

Maximum Mark: 30

Published

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or extra guidance)
AW	alternative wording (where responses vary more than usual)
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
ecf	error carried forward
l	ignore
mp	marking point (with relevant number)

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Question	Answer	Marks	Guidance
1(a)	<i>independent variable:</i> <u>concentration</u> of caffeine ; <i>dependent variable:</i> number of (heart) beats per unit time / heart rate ;	2	
1(b)(i)	use two tablets ; add 1 dm ³ or 1000 ml / cm ³ or 1 litre (distilled) water ;	2	A any correct proportions of water and tablets whatever the total volume, e.g. one tablet in 500 cm ³ / 0.5 dm ³ water
1(b)(ii)	to keep it in one position / to stop it from moving / swimming (to make it easier to count the heart beat) ;	1	
1(b)(iii)	<i>max 6 of:</i> 1 <i>ref. to a method of diluting 100 mg dm⁻³ caffeine solution, e.g. proportional / simple / serial dilution or a description and minimum of 4 additional dilutions ;</i> 2 <i>ref. to concentrations from 100 mg dm⁻³ <u>downwards with correct units</u> ;</i> <i>values stated <u>must</u> correspond to the dilution method chosen</i> 3 use of water / 0 mg dm ⁻³ as a <u>control</u> ; 4 allow <i>Daphnia</i> to acclimatise after adding caffeine / to absorb the caffeine ; 5 <i>ref. to method of counting number of heart beats, e.g. clicker counter / tally counter / record dots on paper and count / video ;</i> 6 use of same period of time (for counting ; 7 same volume / same number of drops of caffeine solution added to each slide ; <i>if a value stated must be max 1 cm³ or 5 drops</i>	6	<i>proportional / simple:</i> (100), 80, 60, 40, 20, (0) mg dm ⁻³ <i>serial:</i> (100), 50, 25, 12.5, 6.25 / (100), 10, 1, 0.1, 0.01 mg dm ⁻³ <i>must have a minimum of 3 others between 0.0 and 100.0 mg dm⁻³</i> <i>standardising variables (mp6–mp8) – must be clear that all the concentrations have been tested or one concentration has been tested more than once on <u>Daphnia</u></i>

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	<p>8 use the same organism / same size / same length / same age / same species / same type <i>Daphnia</i> for all caffeine concentrations ;</p> <p>9 <i>ref. to</i> a minimum of three replicates and calculate a <u>mean</u> or identify / eliminate / remove / ignore anomalies or outliers ;</p> <p>10 description of ethical treatment of live <i>Daphnia</i> AW, e.g. careful handling (when being moved) to minimise damage / return to tank promptly after testing / minimum time in caffeine solution ;</p> <p>11 low risk experiment / suitable hazard and safety precaution, e.g. allergy to caffeine and gloves ;</p>																		
1(b)(iv)	<p><i>source of error is max 1 and must be clearly stated</i> <i>improvement is max 1 and must match the source of error</i></p> <table border="1" data-bbox="344 753 1249 1430"> <thead> <tr> <th data-bbox="344 753 797 804">error</th> <th data-bbox="797 753 1249 804">improvement</th> </tr> </thead> <tbody> <tr> <td data-bbox="344 804 797 890">heat from light in microscope ;</td> <td data-bbox="797 804 1249 890">turn lamp on only when needed / heat shield ;</td> </tr> <tr> <td data-bbox="344 890 797 976">evaporation of water from slide ;</td> <td data-bbox="797 890 1249 976">use a cover slip / top up with same solution ;</td> </tr> <tr> <td data-bbox="344 976 797 1094">animals are stressed ;</td> <td data-bbox="797 976 1249 1094">handle only when needed / minimise time in experimental conditions ;</td> </tr> <tr> <td data-bbox="344 1094 797 1177">cumulative effect of caffeine (on one <i>Daphnia</i>) ;</td> <td data-bbox="797 1094 1249 1177">allow recovery time / use different <i>Daphnia</i> ;</td> </tr> <tr> <td data-bbox="344 1177 797 1264">difficulty in counting ;</td> <td data-bbox="797 1177 1249 1264">any suitable improvement, e.g. video and slow down ;</td> </tr> <tr> <td data-bbox="344 1264 797 1350">no time allowed for caffeine absorption ;</td> <td data-bbox="797 1264 1249 1350">have a time delay before counting ;</td> </tr> <tr> <td data-bbox="344 1350 797 1430">drop size varies ;</td> <td data-bbox="797 1350 1249 1430">use a known volume of caffeine solution ;</td> </tr> </tbody> </table>	error	improvement	heat from light in microscope ;	turn lamp on only when needed / heat shield ;	evaporation of water from slide ;	use a cover slip / top up with same solution ;	animals are stressed ;	handle only when needed / minimise time in experimental conditions ;	cumulative effect of caffeine (on one <i>Daphnia</i>) ;	allow recovery time / use different <i>Daphnia</i> ;	difficulty in counting ;	any suitable improvement, e.g. video and slow down ;	no time allowed for caffeine absorption ;	have a time delay before counting ;	drop size varies ;	use a known volume of caffeine solution ;	2	<p>A any other valid source of error and a suitable improvement I <i>ref. to</i> magnification used</p>
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Question	Answer	Marks	Guidance
1(c)	<i>Daphnia</i> belong to a different phylum / data collected was not from humans ;	1	A any <i>ref.</i> to differences in heart structure of humans and <i>Daphnia</i>
1(d)(i)	(2.4 mg 100cm ⁻³ cola, trial 3) <u>228</u> ;	1	
1(d)(ii)	<p><i>max 2 of:</i></p> <p>range of concentration too narrow ;</p> <p>no data for caffeine at 0.0 / below 2.4 / above 6.0 mg cm⁻³ ;</p> <p>not enough concentration / only 4 concentrations ;</p> <p>there is overlap between some of data collected for 4.8 and 6.0 mg cm⁻³ ;</p> <p><i>idea that</i> proportional increases in concentration should give a proportional increase in heart rate ;</p>	2	

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Question	Answer	Marks	Guidance
2(a)	there is no <u>significant</u> correlation / relationship / association between the percentage / proportion of cyanogenic <i>T. repens</i> and (increasing mean January) temperature ;	1	
2(b)(i)	column 3 completed correctly ; column 6 completed correctly ;	2	ecf for column 6 from errors in column 3

1	2	3	4	5	6	7
location	percentage of cyanogenic <i>T.repens</i> plants	rank of percentage of cyanogenic <i>T.repens</i> plants	mean January temperature /°C	rank of mean January temperature	difference in rank, <i>D</i>	<i>D</i> ²
Almora	85	8	12.2	8	0	0
Fairbanks	5	2	-23.9	1	1	1
Karaj River	64	5	4.4	6	-1	1
Konosu	50	4	4.2	5	-1	1
Lennoxville	71	7	-10.0	4	3	9
Mandan	33	3	-12.8	3	0	0
Novosibirsk	0	1	-19.4	2	-1	1
Pretoria	68	6	10.0	7	-1	1
Rabat	100	9 ;	12.5	9	0 ;	0
					$\Sigma D^2 =$	14

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Question	Answer	Marks	Guidance
2(b)(ii)	$r_s - 1 - \frac{(6 \times 14)}{(9^3 - 9)} ;$ $r_s - 1 - \frac{(84)}{(720)}$ $r_s = \underline{0.88} ;$	2	<i>max 1 if correct answer is given to more than 2 d.p.</i>
2(b)(iii)	calculated value / <u>0.88</u> , is greater than, the critical value / <u>0.68</u> or critical value / <u>0.68</u> , is less than, the calculated value / <u>0.88</u> ;	1	ecf from incorrect answer in 2(b)(ii)
2(b)(iv)	<i>max 1 of:</i> <i>idea that cyanogenic plants grow better at higher temperature ;</i> <i>idea that cyanogenic plants more able to survive grazing (by herbivores) ;</i> <i>idea that cyanogenic plants produce more hydrogen cyanide which, reduces grazing / kills (more), herbivores ;</i>	1	<i>must be comparative</i>

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Question	Answer	Marks	Guidance
3(a)	<p><i>max 3 of:</i> same location / area used ; same time of year / same two weeks in August ; traps were equally spaced (along the transect) ; along same transects / transects were at the same places ; numbers calculated per 1000 traps / same number of traps were used ;</p>	3	1 species of vole
3(b)	<p>1 $q^2 = 0.16$ or $\frac{8}{50}$ or $\frac{4}{25}$ or 16% OR $q = 0.4$ or $\frac{2}{5}$ or 4% ;</p> <p>2 derives $2pq$ correctly from a clearly stated value of p and a clearly stated value of q ;</p> <p>3 in 1997 heterozygous voles = $(0.48 \times 60) = 29$ voles ;</p>	3	<p><i>max 2 if answer not rounded or p is incorrect</i> A answers in equation as percentages</p> <p>2 ecf if q is incorrect (e.g. $q = 0.16$) but then correctly used to get $2pq$</p> <p>3 ecf (any number) $\times 60$ (from graph) and a <u>whole</u> number rounded correctly</p>