Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2019**

MARK SCHEME

Maximum Mark: 30

Published

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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- marks are awarded when candidates clearly demonstrate what they know and can do
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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

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GENERIC MARKING PRINCIPLE 6:

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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 guidance for examiners)
I	ignore (for answers that include irrelevant information that does not contradict the expected answer)
AW	alternative wording (where responses vary more than usual)
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underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ecf	error carried forward
mp	marking point (with relevant number)

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Question	Answer	Marks
1(a)(i)	0.13 ;	**1**
1(a)(ii)	(reaction time would be) unchanged ; **or** (reaction time would be) longer / AW ;	**1**
1(b)(i)	distance ruler, drops / falls ;	**1**
1(b)(ii)	*any 7 of:* 1. test in silence / quiet / AW **and** noise / AW ; 2. method to ensure silence ; 3. ensure consistent / similar / same / known, level / volume / loudness / decibels, of noise / AW ; 4. suitable number of people tested ; 5. *idea of* no warning given when ruler to be dropped ; 6. *detail of ruler use:* same, ruler / starting distance / type or weight of ruler / held vertically ; 7. same or similar age / same sex ; 8. use same / dominant, hand ; 9. no, (named) drugs / medications / stimulants / depressants ; 10. *idea of* avoiding people with conditions affecting reaction time e.g. poor hearing / poor sight / neurological disorders ; 11. same, time of day / stated time ; 12. *ref. to* a minimum of three repeats **and** calculate a mean ; 13. low / medium, risk ;	**7**
1(c)	(independent variable / sound present or absent, is) discontinuous / discrete / qualitative / categoric, variable ;	**1**
1(d)(i)	*absence of noise* (mean) reaction time is longer **or** *presence of noise* (mean) reaction time is shorter ;	**1**
1(d)(ii)	comparing (two) means / continuous data / normal distribution ;	**1**
1(d)(iii)	there is no (significant) difference between the (mean) reaction times for no (background) noise and (background) noise ;	**1**

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Question	Answer	Marks
1(d)(iv)	not significant / is due to chance (at $p > 0.05$) **and** because, it / calculated value / 2.05, is less than, the critical value of *t* / table value of *t* / 2.12 **; ora**	**1**
1(e)(i)	*idea of* the (number of), repeats (of the task) / AW **;**	**1**
1(e)(ii)	*idea that* as repeats increase, (number of) errors decrease / accuracy increases **;**	**1**
1(e)(iii)	(student **Y**, replicate 5) – circle around the number 44 **;**	**1**
1(e)(iv)	*idea of* (student) **Y and** as, had fewer errors / were more accurate (than rest of students) **;** **or** as (results) start off lower / as (results) are lower in trial one / as even from the very beginning (results) are lower **;**	**1**
1(f)	*any 2 of:* *idea that* the more, replicates / repeats, carried out, fewer errors are made **;** *idea of* after, 6–7 / several trials, number of errors starts to plateau / number of errors does not continue to decrease **;** *idea that* interruptions / AW, increases number of errors **;**	**2**

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Question	Answer	Marks
2(a)(i)	50 (cm^3) **;**	**1**
2(a)(ii)	7 (straws) **;**	**1**
2(b)	*any 4 of:* *estimate of numbers:* 1. calculate the volume of the sample **or** volume of sample is, (for mm^3) 0.25 × 0.25 × 0.1 / 0.00625 / 6.25 × 10^{-3} / (for cm^3) 0.025 × 0.025 × 0.01 / 0.00000625 / 6.25 × 10^{-6} **;** 2. divide the number of sperm by the volume **and** method of converting to cm^3 **;** *deciding which sperm to include:* 3. *idea of:* count those where sperm (fully) inside **the** square / 0.0625 (mm^2) / all (small) squares / haemocytometer / quadrant / grid **;** 4. *idea of:* include those touching the (line) top and left / up and right **or** exclude those touching bottom and right / down and left **;** *detail of method:* 5. AVP **;** e.g. *ref to* dilution of sample / stirring / even spreading / immobilising sperm / use of coverslip / screenshot for counting **;**	**4**
2(c)	*sugar: idea that* (it) provides or gives energy / is an energy source / (is used) in respiration / (is used) to produce ATP **;** *buffer:* (change in pH may), denature enzymes / proteins **;** *antibiotics: idea of*, killing / stopping reproduction of, bacteria / AW **;**	**3**

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Question	Answer	Marks
1(a)(i)	*any 2 of:* 1. easy to explain / easy to do / no complex apparatus **;** 2. mobility / physical strength / stamina (of subject), is not necessary **;** 3. no calculations needed to get reaction time AW **;** 4. results are more accurate / precise **;**	**2**
1(a)(ii)	*independent variable*: age **;** *dependent variable*: reaction time **;**	**2**
1(a)(iii)	*any 6 of:* 1. *ref. to* suitable number of people in total **;** 2. *ref. to* equally spread, age categories **;** 3. *ref. to* same number males and females each group **;** 4. *ref. to* consent form (e.g. using data / children / AW) **;** 5. *ref. to* standard conditions for the test, e.g. same (type of) computer / tablet / software / same colour change **;** 6. *ref. to* same, stated, **room** conditions **;** 7. *ref. to* avoiding people with conditions affecting reaction time e.g. poor eyesight / colour-blind / neurological disorders **;** 8. no, (named) drugs / medications / caffeine / alcohol **;** 9. *ref. to* testing at same time of day / stated time **;** 10. *ref. to* using same hand to push the button **;** 11. minimum of three tests on each subject **and** taking a mean **or** minimum of three subjects in same age category **and** taking a mean **;** 12. low / medium risk experiment / parent or guardian present for children / carer for vulnerable adults **;**	**6**
1(b)(i)	$\frac{(340-210)}{340} \times 100$ = 38% **;;**	**2**

Question	Answer	Marks
1(b)(ii)	*any 2 of:* (mean) reaction time in females is higher than in males (at most ages) **;** reaction time decreases (to age 20 years), **then** starts to increase **;** (due to overlaps of SD lines) there is no significant difference between (male and female) reaction times **;**	**2**
1(b)(iii)	*t*-test **;** data is continuous / comparing means / standard deviations are approximately the same **;**	**2**
1(b)(iv)	there is no (significant) difference in the (mean) reaction time between males and females (at same age) **;**	**1**

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Question	Answer	Marks
2(a)(i)	*award mp4 only if 2 marks not already awarded* *any 2 of:* 1. count the sperm inside the (complete) square(s) **;** 2. include sperm with heads inside the square(s) **;** 3. include those touching the line (of square) top and left (and exclude those touching bottom and right) **;** 4. (calculate the) volume of 1 square / $0.05 \times 0.05 \times 0.10$ / 2.5×10^{-4} mm^3 **;**	**2**
2(a)(ii)	1. (calculate the) volume of 1 square / $0.05 \times 0.05 \times 0.10$ / 2.5×10^{-4} mm^3 **;** 2. divide number sperm (in *n* squares) by volume (in *n* squares) **or** divide 1 mm^3 by the volume (in *n* squares) **and** multiply by the number of sperm counted (in *n* squares) **;** 3. multiply by, the dilution factor / 100 **;**	**3**
2(a)(iii)	*any 2 of:* *idea of* small <u>volume</u> / only a sample (volume) is taken **;** (sperm moving so) easy to miscount / harder to count **;** sperm, not evenly distributed / forms clumps / overlap **;** not repeated **;**	**2**
2(b)(i)	*any 2 of:* (no) smoking **;** (no) alcohol **;** (no) medication **;** sperm tested within 2 hours of collection **;** sperm count in a fixed volume (mm^3) **;**	**2**
2(b)(ii)	for comparison **;**	**1**

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Question	Answer	Marks
2(b)(iii)	*any 1 of:* **1.** high(er) FSH **and** low(er) LH, reduces sperm motility / causes group 2 infertility **;** 2. **only** high(er) FSH / high FHS and normal LH, reduces sperm number / causes group 3 infertility **;** 3. FSH **and** LH, both high, prevents sperm release / prevents sperm production / causes no sperm / causes group 4 infertility **;**	**1**
2(c)	count / record the number of, live and dead sperm / sperm of the two different colours / live and total **;** method to calculate the proportion **;**	**2**

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I	ignore
AVP	alternative valid point

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>independent: sex / male or female / boy or girl ;
dependent: reaction time ;</td><td>2</td></tr>
<tr><td>1(a)(ii)</td><td>categoric ;</td><td>1</td></tr>
<tr><td>1(a)(iii)</td><td>any 6 of:

1. ref. to suitable number of people in total ;
2. same / similar ages ;
3. same number boys and girls in each group ;
4. ref. to consent form (e.g. using data / children / AW) ;
5. ref. to standard conditions for the test, e.g. same (type of) computer / tablet / software / same colour change ;
6. ref. to same, stated, room conditions ;
7. ref. to avoiding people with conditions affecting reaction time e.g. poor eyesight / colour-blind / neurological disorders ;
8. no, (named) drugs / medications / caffeine / alcohol ;
9. ref. to testing at same time of day / stated time ;
10. ref. to using same hand to push the button ;
11. minimum of three tests on each subject and taking a mean
OR
minimum of three subjects of each sex and taking a mean ;
12. low / medium risk experiment / parent or guardian present for children / carer for vulnerable adults ;</td><td>6</td></tr>
<tr><td>1(a)(iv)</td><td>idea of processing delay from computer / AW ;</td><td>1</td></tr>
<tr><td>1(b)</td><td><table><tr><td>mode</td><td>0.26</td><td>0.25</td></tr><tr><td>median</td><td>0.25 ;</td><td>0.26</td></tr></table></td><td>1</td></tr>
</table>

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Question	Answer	Marks
1(c)(i)	comparing (two) means / continuous data / normal distribution ;	**1**
1(c)(ii)	there is no (significant) difference in the (mean) reaction time (in right handed people) when using the left or right hand ;	**1**
1(c)(iii)	20 ;	**1**
1(c)(iv)	less than 2.09 / less than the critical value (at $p = 0.05$) ;	**1**
1(d)(i)	7.9 (trial 11, student 2, before measurement) ;	**1**
1(d)(ii)	*idea that* affected data should be left out ;	**1**
1(d)(iii)	student 3 (no mark) (as their) standard deviations / s, are largest ;	**1**
1(d)(iv)	*supports* *any 1 of:* 1. *Idea that* mean measurement for students was close(r) to, the actual measurement / 7.5, after feedback had been given ; 2. mean +/- *s* before feedback does not overlap with mean +/- *s* after feedback for, students 2 / 3 ; 3. AVP ; *does not support* *any 1 of:* 4. small sample size / only 3 students tested ; 5. mean +/- *s* for student 1 before and after feedback overlap 6. *idea that* improvement in accuracy in student 3 is small / 1.5 to 1.4 (cm) change in closeness to mean ; 7. *idea of* no statistical analysis to determine if difference in results is significant or not ; 8. AVP ;	**2**

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Question	Answer	Marks
2(a)(i)	*any 3 of*: 1. (same) volume / 10 cm^3, of semen ; 2. (same) speed of spinning / spun at 1275 revolutions per minute ; 3. (same) time for spinning / spun for 20 minutes; 4. (same) volume / 15 cm^3, of buffer ;	**3**
2(a)(ii)	*any 1 of*: *idea that:* some sperm cells may get damaged ; separation of X-bearing and Y-bearing sperm is not achieved / all sperm collect at the bottom of the tube ; AVP ;	**1**
2(b)	14 ;	**1**

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Question	Answer	Marks
2(c)	*any 5 of*: *estimate of numbers:* 1. idea of find the volume of the sample **or** (volume of sample is) – (for mm^3) $0.25 \times 0.25 \times 0.1$ / 0.00625 / 6.25×10^{-3} (for cm^3) $0.025 \times 0.025 \times 0.01$ / 0.00000625 / 6.25×10^{-6} **;** 2. divide the number of sperm by the volume **or** divide 1 mm^3 by the volume **and** multiply by the number of sperm counted **;** 3. evidence of correct method of converting to cm^3 **;** *deciding which sperm to include:* 4. *idea of:* count those where sperm (fully) inside, the square / 0.0625 (mm^2) / all (small) square**s** / haemocytometer / quadrant / grid / boxes **;** 5. *idea of:* including those in or partially in the inner double lines **;** 6. *idea of:* including those (in edge region) top and left / up and right **or** exclude those in edge region) bottom and right / down and left **;** 7. AVP *detail of method: e.g. ref. to*, dilution / stirring / even spreading / immobilising sperm / use of coverslip / screenshot for counting / *idea of* only counting non- deformed / sperm **;**	**5**