Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **October/November 2023**

MARK SCHEME

Maximum Mark: 30

Published

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GENERIC MARKING PRINCIPLE 1:

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GENERIC MARKING PRINCIPLE 2:

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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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1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non–contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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Examples of how to apply the list rule

State **three** reasons … [3]

A

1	Correct	✓	**2**
2	Correct	✓	
3	Wrong	×	

B **(4 responses)**

1	Correct, Correct	✓, ✓	**3**
2	Correct	✓	
3	Wrong	ignore	

C **(4 responses)**

1	Correct	✓	**2**
2	Correct, Wrong	✓, ×	
3	Correct	ignore	

D **(4 responses)**

1	Correct	✓	**2**
2	Correct CON (of 2.)	×, (discount 2)	
3	Correct	✓	

E **(4 responses)**

1	Correct	✓	**3**
2	Correct	✓	
3	Correct, Wrong	✓	

F **(4 responses)**

1	Correct	✓	**2**
2	Correct	✓	
3	Correct CON (of 3.)	× (discount 3)	

G **(5 responses)**

1	Correct	✓	**3**
2	Correct	✓	
3	Correct Correct CON (of 4.)	✓ ignore ignore	

H **(4 responses)**

1	Correct	✓	**2**
2	Correct	×	
3	CON (of 2.) Correct	(discount 2) ✓	

I **(4 responses)**

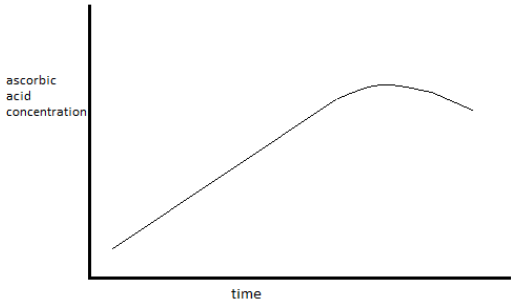
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max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)(i)	*any **one** from:* 1 *idea that* size (of apple) may not be, related / proportional, to ripeness **;** 2 *idea that* (individual) apples may, ripen at different rates / AW **;** 3 *idea that* other factors may affect, ripeness of apples / diameter of apples **;**	**1**
1(a)(ii)	*any **one** from:* 1 (pick apples with the) same / similar / AW, sugar content / colour / softness / age **;** 2 test / measure / AW, sugar content / colour / softness / age (of apples) **;**	**1**
1(b)	1 correct axis labels **;** 2 correct shaped line **;**  	**2**
1(c)(i)	1 90 **;** 2 50 **;**	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(c)(ii)</td><td>
any nine from:

1 idea of test on at least 5 days ;
2 use apples from same, tree / variety / type ;
3 use, same / stated, storage conditions (of apples) ;
prepare apple extract solutions:
4 remove the, skin / seeds, of the apple ;
5 use, set / stated, mass of apple ;
6 method to, grind / AW, apple ;
7 centrifuge / filter ;
measure ascorbic acid concentration using DCPIP:
8 place, set / stated, volume of (apple extract) solution in, conical flask / AW ;
9 idea of adding DCPIP dropwise to (apple extract) solution until blue colour remains ;
10 shake / mix / AW (after each drop of DCPIP) ;
11 measure / record, volume of DCPIP used (to reach end point) ;
12 read volume from bottom of meniscus (in burette) ;
13 use at least three replicates for each day and calculate a mean (DCPIP volume) ;
14 safety comment with hazard and risk and precaution ;

<table>
<tr><th>hazard</th><th>risk</th><th>precaution</th></tr>
<tr><td>DCPIP</td><td>irritant / toxin / allergy</td><td>gloves / goggles / mask / PPE</td></tr>
<tr><td>apples</td><td>allergy</td><td>gloves / goggles / mask / PPE / medication / do not eat</td></tr>
<tr><td>knife / scalpel</td><td>injury</td><td>cut away from hand</td></tr>
</table>
</td><td>9</td></tr>
<tr><td>1(d)</td><td>
any two from:

1 data is continuous ;
2 scatter diagram, suggests a linear, relationship ;
3 data is normally distributed ;
</td><td>2</td></tr>
</table>

Question	Answer	Marks
1(e)	*any **three** from:* *for the conclusion:* 1 apples have the second lowest β–carotene concentration (of the fruits shown) **;** 2 quoted data from Fig. 1.3 to support **;** 3 *idea that* spread of data for apple is lower (than most fruits that were tested, as SD is smaller) *against the conclusion:* 4 *idea that* need to calculate, SE / 95% CI (to make a conclusion) **;** 5 no statistical test carried out **;** 6 *idea that* only 5 fruits were tested **;**	**3**

Question	Answer	Marks
2(a)(i)	*independent variable:* type / AW , of trypsin **;** *dependent variable:* time (taken to break down gelatine) **;**	**2**
2(a)(ii)	*any **one** from*: 1 pH (of solution) **;** 2 surface area / mass / volume, of cube **;** 3 concentration of, gelatine / collagen, in cube **;**	**1**
2(b)(i)	*mean* = 131.1 **;**	**1**
2(b)(ii)	*s* = 3.2 **;**	**1**
2(b)(iii)	*any **three** from:* 1 critical value (at degrees of freedom = 22 and *p* = 0.05) = 2.074 **;** 2 calculated (*t*–) value / 2.663 is, greater than, critical (*t–)* value / 2.074 **; ora** 3 null hypothesis is rejected **;** 4 there is a <u>significant difference</u> (at *p* = 0.05) **;**	**3**

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Question	Answer	Marks
2(b)(iv)	*any **two** from:* 1 *idea that* salmon trypsin is adapted to colder temperatures **; ora** 2 (at 20 °C) salmon trypsin forms enzyme–substrate complexes at a faster rate (than pig trypsin) **; ora** 3 AVP **;**	**2**

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A	1	Correct	✓	**2**
	2	Correct	✓	
	3	Wrong	×	
B	1	Correct, Correct	✓, ✓	**3**
(4 responses)	2	Correct	✓	
	3	Wrong	ignore	
C	1	Correct	✓	**2**
(4 responses)	2	Correct, Wrong	✓, ×	
	3	Correct	ignore	
D	1	Correct	✓	**2**
(4 responses)	2 (of 2.)	Correct, CON	×, (discount 2)	
	3	Correct	✓	

E	1 Correct	✓	**3**
(4 responses)	2 Correct	✓	
	3 Correct, Wrong	✓	

F	1 Correct	✓	**2**
(4 responses)	2 Correct	✓	
	3 Correct CON (of 3.)	× (discount 3)	

G	1 Correct	✓	**3**
(5 responses)	2 Correct	✓	
	3 Correct Correct CON (of 4.)	✓ ignore ignore	

H	1 Correct	✓	**2**
(4 responses)	2 Correct	×	
	3 CON (of 2.) Correct	(discount 2) ✓	

I	1 Correct	✓	**2**
(4 responses)	2 Correct	×	
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Question	Answer	Marks
1(a)	*any **two** from* 1 low tide **;** 2 day / date / month / season **;** 3 (same) rocky shore / (same) location **;** 4 (mid-shore) zone **;** 5 random selection of rock pools **;** 6 deepest part of rock pool measured **;**	**2**
1(b)(i)	there is no correlation between, species diversity / number of (different) species and depth **;**	**1**
1(b)(ii)	*any **three** from* 1 critical value for (p = 0.05) = 0.350 **;** 2 value for, r_s / calculated value, is > than critical value **;** 3 null hypothesis is rejected **;** 4 there is a significant correlation (between depth of rock pool and species diversity) **;** 5 there is a positive correlation (between rock pool depth and species diversity) **;**	**3**
1(b)(iii)	1. scatter diagram, does not indicate, a linear, relationship **;** 2. (data is) not normally distributed **;** 3. species diversity / number of species, is not continuous ;	**1**
1(c)	*any **two** from* 1 location of the rocky shore is unknown **;** 2 position of the mid-shore zone is unknown **;** 3 size of rock pools is unknown **;** 4 location of rock pool is unknown **;** 5 height, of tide / tides, unknown ;	**2**

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Question	Answer	Marks
1(d)	*any **seven** from* *sampling process* 1 belt transect **;** 2 place a, rope / AW, from LWM to HWM **;** 3 sample at regular intervals along the transect **;** 4 use a quadrat **;** 5 same / same size of, quadrat ; *measuring process* 6 method of identifying species (of algae) **;** 7 take care not to miss small species ; 8 (count / record) number of (different) species (of algae) (in each quadrat) **;** 9 method for determining abundance of each species (in each quadrat) **;** 10 repeat belt transect at two other positions along the shore and calculate means **;** 11 named suitable hazard and risk and precaution **;** 12 AVP **;**	**7**

Question	Answer	Marks
2(a)	*any **one** from:* suitable method for measuring a curve **;** straighten shoot (before measuring) **;**	**1**
2(b)(i)	38.7 and 45.3 **;**	**1**
2(b)(ii)	difference is significant **;**	**1**
2(c)	*any **two** from:* 1 ABA reduces (shoot) growth **;** 2 SA increases (shoot) growth (by day 5) **;** 3 ABA prevents, cell elongation / cell division **or** SA stimulates, cell elongation / cell division **;** 4 description of the effect on growth by treatment C (ABA + SA) **;** 5 ABA (partly) counteracts the effect (on growth) of SA **or** SA (partly) counteracts the effect (on growth) of ABA **;**	**3**
2(d)	1 appropriate method of applying the solutions / hormones, to the roots only **;** *max. **two** from:* 2 same volume of solutions **;** 3 measuring shoot lengths on day 1 and day 5 **;** 4 named example of condition which is same as shoot spraying experiment **;** 5 method to identify presence of hormone in shoot **;**	**3**

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<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(e)(i)</td><td>one mark per row
<table>
<tr><th rowspan="2">gene</th><th colspan="2">effect on gene expression</th></tr>
<tr><td>ABA alone</td><td>SA alone</td></tr>
<tr><td>CDKB2</td><td>large decrease</td><td>no change / small increase ;</td></tr>
<tr><td>KRP4</td><td>large increase</td><td>no change / small increase ;</td></tr>
<tr><td>CycD6</td><td>large decrease</td><td>no change / small decrease ;</td></tr>
</table></td><td>3</td></tr>
<tr><td>2(e)(ii)</td><td>conclusion 1
fully supports <u>and</u> mRNA (ABA + SA / batch C) lower than with ABA (batch B) / ora ;

conclusion 2
partially supports <u>and</u> mRNA (ABA + SA / batch C) higher than with ABA (batch B) but not as high as with water (batch A) / SA (batch D)
or
no statistical <u>test</u> carried out ;</td><td>2</td></tr>
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2	Correct	✓	
3	Wrong	×	

B
(4 responses)

1	Correct, Correct	✓, ✓	**3**
2	Correct	✓	
3	Wrong	ignore	

C
(4 responses)

1	Correct	✓	**2**
2	Correct, Wrong	✓, ×	
3	Correct	ignore	

D
(4 responses)

1	Correct	✓	**2**
2	Correct CON (of 2.)	×, (discount 2)	
3	Correct	✓	

E
(4 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct, Wrong	✓	

F
(4 responses)

1	Correct	✓	**2**
2	Correct	✓	
3	Correct CON (of 3.)	× (discount 3)	

G
(5 responses)

1	Correct	✓	**3**
2	Correct	✓	
3	Correct Correct CON (of 4.)	✓ ignore ignore	

H
(4 responses)

1	Correct	✓	**2**
2	Correct	×	
3	CON (of 2.) Correct	(discount 2) ✓	

I
(4 responses)

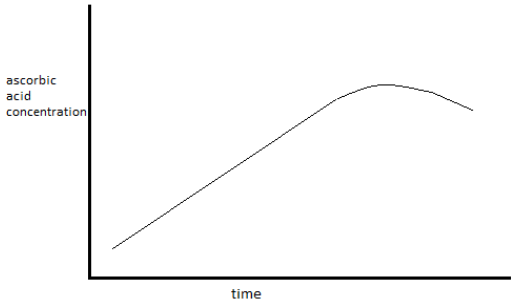
1	Correct	✓	**2**
2	Correct	×	
3	Correct CON (of 2.)	✓ (discount 2)	

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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 by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	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
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)(i)	*any **one** from:* 1 *idea that* size (of apple) may not be, related / proportional, to ripeness **;** 2 *idea that* (individual) apples may, ripen at different rates / AW **;** 3 *idea that* other factors may affect, ripeness of apples / diameter of apples **;**	**1**
1(a)(ii)	*any **one** from:* 1 (pick apples with the) same / similar / AW, sugar content / colour / softness / age **;** 2 test / measure / AW, sugar content / colour / softness / age (of apples) **;**	**1**
1(b)	1 correct axis labels **;** 2 correct shaped line **;**  	**2**
1(c)(i)	1 90 **;** 2 50 **;**	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(c)(ii)</td><td>
any nine from:

1 idea of test on at least 5 days ;
2 use apples from same, tree / variety / type ;
3 use, same / stated, storage conditions (of apples) ;
prepare apple extract solutions:
4 remove the, skin / seeds, of the apple ;
5 use, set / stated, mass of apple ;
6 method to, grind / AW, apple ;
7 centrifuge / filter ;
measure ascorbic acid concentration using DCPIP:
8 place, set / stated, volume of (apple extract) solution in, conical flask / AW ;
9 idea of adding DCPIP dropwise to (apple extract) solution until blue colour remains ;
10 shake / mix / AW (after each drop of DCPIP) ;
11 measure / record, volume of DCPIP used (to reach end point) ;
12 read volume from bottom of meniscus (in burette) ;
13 use at least three replicates for each day and calculate a mean (DCPIP volume) ;
14 safety comment with hazard and risk and precaution ;

<table>
<tr><th>hazard</th><th>risk</th><th>precaution</th></tr>
<tr><td>DCPIP</td><td>irritant / toxin / allergy</td><td>gloves / goggles / mask / PPE</td></tr>
<tr><td>apples</td><td>allergy</td><td>gloves / goggles / mask / PPE / medication / do not eat</td></tr>
<tr><td>knife / scalpel</td><td>injury</td><td>cut away from hand</td></tr>
</table>
</td><td>9</td></tr>
<tr><td>1(d)</td><td>
any two from:

1 data is continuous ;
2 scatter diagram, suggests a linear, relationship ;
3 data is normally distributed ;
</td><td>2</td></tr>
</table>

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Question	Answer	Marks
1(e)	*any **three** from:* *for the conclusion:* 1 apples have the second lowest β–carotene concentration (of the fruits shown) **;** 2 quoted data from Fig. 1.3 to support **;** 3 *idea that* spread of data for apple is lower (than most fruits that were tested, as SD is smaller) *against the conclusion:* 4 *idea that* need to calculate, SE / 95% CI (to make a conclusion) **;** 5 no statistical test carried out **;** 6 *idea that* only 5 fruits were tested **;**	**3**

Question	Answer	Marks
2(a)(i)	*independent variable:* type / AW , of trypsin **;** *dependent variable:* time (taken to break down gelatine) **;**	**2**
2(a)(ii)	*any **one** from*: 1 pH (of solution) **;** 2 surface area / mass / volume, of cube **;** 3 concentration of, gelatine / collagen, in cube **;**	**1**
2(b)(i)	*mean* = 131.1 **;**	**1**
2(b)(ii)	*s* = 3.2 **;**	**1**
2(b)(iii)	*any **three** from:* 1 critical value (at degrees of freedom = 22 and *p* = 0.05) = 2.074 **;** 2 calculated (*t*–) value / 2.663 is, greater than, critical (*t–)* value / 2.074 **; ora** 3 null hypothesis is rejected **;** 4 there is a <u>significant difference</u> (at *p* = 0.05) **;**	**3**

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Question	Answer	Marks
2(b)(iv)	*any **two** from:* 1 *idea that* salmon trypsin is adapted to colder temperatures **; ora** 2 (at 20 °C) salmon trypsin forms enzyme–substrate complexes at a faster rate (than pig trypsin) **; ora** 3 AVP **;**	**2**

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