

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

## **MARK SCHEME for the October/November 2015 series**

### **9700 BIOLOGY**

**9700/52**

Paper 5 (Planning, Analysis and Evaluation),  
maximum raw mark 30

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Mark scheme abbreviations:

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

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	type(s) of enzyme / endopeptidase or exopeptidase ;	A – the enzyme / the protease	[1]
(ii)	(max 1) Temperature + pH + time between samples ;  2 of (max 2): temperature – use a water bath / incubator / thermostatically controlled room ;  pH – use a buffer ;  time intervals – use a stop clock / stop watch / timer / AW ;	R if more than 3 given A description of time / sample at 5 minute intervals  <i>method must match the related variable</i> I air conditioning  A named buffer R neutral buffer	[max 3]
(iii)	<i>idea of</i> when two (successive) chromatograms give the same results <b>or</b> no more change in results / chromatograms / spots ;		[1]
(b)	A from diagrams where applicable 8 of: mp1 <i>idea of</i> chromatograms using hydrolysed extracts of <b>both</b> enzymes ;  mp2 <i>ref. to</i> observing / counting the number of, spots / AW <b>or</b> measurement of the distance moved by each product ;  mp3 comparison between chromatograms of the different proteases ;	A <i>ref. to</i> known markers / known standard chromatogram I (calculate) $R_f$ unqualified <i>must have an idea of measuring a distance</i> A if $R_f$ formula given which includes, spot / AW, distance	

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Question	Expected answer	Extra guidance	Mark
	<p>mp4 <i>ref. to</i> running <b>all</b> chromatograms for same time <b>or</b> running to same distance moved by solvent front ;</p> <p>mp5 <i>ref. to</i> same number of applications applied to origin ;</p> <p><i>procedure</i></p> <p>mp6 <i>ref. to</i> using capillary tube to give a spot (on the chromatography paper) ;</p> <p>mp7 <i>ref. to</i> drawing <b>or</b> using a base line / line of origin ;</p> <p>mp8 <i>idea of</i> concentrating the extract either by drying between adding spots <b>or</b> evaporating the extract (before using) ;</p> <p>mp9 <i>idea of</i> placing in solvent so that the level of solvent is below the origin line / sample / AW ;</p> <p>mp10 <i>ref. to</i> covering to prevent evaporation / maintain a saturated environment ;</p> <p>mp11 <i>ref. to</i> drying before spraying with dye ;</p> <p>mp12 <i>idea of</i> running at least 3 chromatograms for both enzymes ;</p> <p>mp13 <i>ref to</i> taking mean of / averaging, distances travelled by each spot <b>or</b> taking mean of / averaging <math>R_f</math> values ;</p>	<p>if time stated, then minimum of 5 minutes <b>A</b> if both extracts on same chromatogram <b>A</b> <i>idea of</i> 'almost reach / just before, the highest level' <b>I</b> stopping 'before' unqualified <b>R</b> if allow to run off the end <b>A</b> spots / drops / a spot / AW <b>I</b> volume</p> <p><b>A</b> other suitable method of applying sample to give a small spot e.g. pin head / cocktail stick / toothpick / Pasteur pipette / AW</p> <p><b>R</b> if line not drawn with pencil <b>A</b> suitable method for TLC <b>R</b> if extract is dried before using</p> <p><b>A</b> in terms of precise measurements position of line and solvent <b>I</b> the name of the solvent, including water</p> <p><b>I</b> airtight unqualified</p> <p><b>I</b> name of dye</p> <p><i>must have mp1 to credit mp12</i> <b>A</b> 'repeat the experiment 3 times' <i>only if</i> description has a chromatogram from each extract</p> <p><b>R</b> mean unqualified</p>	

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<b>Question</b>	<b>Expected answer</b>	<b>Extra guidance</b>	<b>Mark</b>
	mp14 <i>safety</i> 1 of: <i>ref. to flammable solvents and no naked flames ;</i> <i>ref. to flammable solvent or toxic solvent/dye and safe disposal ;</i> <i>ref. to allergy to dyes/solvents and wear gloves ;</i> <i>ref. to toxic/irritant/corrosive solvent or dye and wear gloves/mask/eye protection/use fume cupboard / keep covered ;</i>	I ref. to the enzymes I chemicals unqualified  A poisonous	[max 8]
<b>(c)</b>	<i>must state whether supported or not with reason</i> mp1 supported, because the time of digestion is shorter / fewer 'spots' ;  mp2 not supported, some will be dipeptides (and tripeptides) ;  mp3 not supported, because there is no evidence or information about charge ;  mp4 supported, as the endoprotease gives the exoprotease more 'ends to work on' ;	<b>ora</b> exoprotease gives more 'spots' / takes longer. <b>A</b> numbers (5/6 vs 17)  <b>A</b> not all single amino acids  <b>A</b> <i>idea that</i> movement is determined by solubility (and not charge) <b>R</b> <i>ref. to</i> weight / movement of the solvent	[4]
<b>(d) (i)</b>	circle around <b>only</b> the 3 <sup>rd</sup> spot from the left on <b>both</b> chromatograms ;	I any circles on the electrophoretograms <b>R</b> if extra spots ringed on chromatograms	[1]
<b>(ii)</b>	<i>need ref. to a sickle or normal peptide/amino acid and ref. to distance</i>  <i>idea that the sickle cell peptide / amino acid has moved a different distance / moved further (from the normal peptide) / ora</i> <b>or</b> <i>(sickle cell) peptide / amino acid has different charge / solubility (from the normal peptide) ;</i>	<i>if direction stated it must be correct e.g. sickle cell peptide has not moved as far to anode (positive electrode)</i> <b>A</b> (sickle cell) spot moves different distance / has moved further / has a different $R_f$ value  I because they look different / different position	[1]
		<b>[Total:19]</b>	

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<b>Question</b>	<b>Expected answer</b>	<b>Extra guidance</b>	<b>Mark</b>
<b>2 (a) (i)</b>	number of aphids (on each surface of the leaf) ;		[1]
<b>(ii)</b>	<i>idea of</i> using the same oily liquid (used for spraying) without the insecticide ;	<b>R</b> water <b>A</b> oily liquid with water	[1]
<b>(b) (i)</b>	(standard error) is an estimate of/ shows the reliability of the (population) mean <b>or</b> is the closeness of sample mean to, population/ actual/ true, mean ;	<i>do not allow definitions of standard deviation</i> <b>I</b> formula used to calculate $S_M$ <b>R</b> accuracy/ reference to results or to data	[1]
<b>(ii)</b>	lower side of leaf treated / group B at 24, 48 and 72 hours ;  there is no overlap between the standard errors/ $S_M$ ;	<b>A</b> any 2 from the 3 times  <b>R</b> error bars	[2]

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Question	Expected answer	Extra guidance	Mark
(c)	<p>assume group <b>A</b> and group <b>B</b> are the treated leaves unless otherwise stated</p> <p>3 of:</p> <p>mp1 there are approximately the same (mean) number of aphids on all of the leaves before spraying ;</p> <p>mp2 in both controls the number of aphids increases ;</p> <p>mp3 insecticide is effective when sprayed on the lower surface of the leaves but not on the upper surface ;</p> <p>mp4 in group <b>B</b> the number of aphids decreases (steeply) by 24 hours ;</p> <p>mp5 in group <b>B</b> the (mean) number of aphids remains low from 24–72 hours ;</p> <p>mp6 in group <b>A</b> the (mean) number of aphids increases (slightly) on the leaves over the time of the investigation / 24 / 48 / 72 hours ;</p> <p>mp7 there is more variation in the number of aphids on the control in Group <b>B</b> ;</p>	<p>I answers given in terms of <math>S_M</math> and reliability</p> <p><b>A</b> the number of aphids goes down in group <b>B</b> but not in group <b>A</b></p> <p><b>A</b> decreases until 48 hours</p> <p><b>A</b> the number of aphids on group <b>B</b> leaves went down and stayed down</p>	[3]
(d) (i)	<p>1 of:</p> <p>comparing two means ;</p> <p>normal distribution ;</p> <p>continuous data ;</p>	<p><b>R</b> continuous variable / continuous variation</p>	[max 1]

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<b>Question</b>	<b>Expected answer</b>	<b>Extra guidance</b>	<b>Mark</b>
<b>(ii)</b>	there is no <b>significant</b> difference in the (mean total) number of aphids on group <b>A</b> and group <b>B</b> <b>or</b> there is no <b>significant</b> difference in the (mean total) number of aphids on the leaves sprayed on the upper side and the leaves sprayed on lower surface ;	the difference in the (mean total) number of aphids on group <b>A</b> and group <b>B</b> is <b>not significant</b>  the difference in the (mean total) number of aphids on the leaves sprayed on the upper side and the leaves sprayed on lower surface is <b>not significant/ not significantly different</b>	[1]
<b>(iii)</b>	<i>idea of 2 samples of 25 and subtracting 1 from each sample ;</i>	<b>A</b> as a formula $(25 - 1) + (25 - 1)$ <b>R</b> $(n - 1) + (n - 1)$ unless n is specified	[1]
		<b>[Total: 11]</b>	