

**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

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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 ;	<b>A</b> – the enzyme / the protease	[1]
(ii)	( <i>max 1</i> ) Temperature + pH + time between samples ;  2 of ( <i>max 2</i> ): temperature – use a water bath / incubator / thermostatically controlled room ;  pH – use a buffer ;  time intervals – use a stop clock / stop watch / timer / AW ;	<b>R</b> if more than 3 given <b>A</b> description of time / sample at 5 minute intervals  <i>method must match the related variable</i> <b>I</b> air conditioning  <b>A</b> named buffer <b>R</b> 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)	<b>A</b> 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 ;	<b>A</b> <i>ref. to</i> known markers / known standard chromatogram <b>I</b> (calculate) $R_f$ unqualified <i>must have an idea of measuring a distance</i> <b>A</b> 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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	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]
(c)	<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]
(d) (i)	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]
(ii)	<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>	