

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

**MARK SCHEME for the October/November 2014 series****9700 BIOLOGY****9700/53**Paper 5 (Planning, Analysis and Evaluation),  
maximum raw mark 53

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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)	there is no significant difference in the activity of, the enzyme / lactase, whatever type of immobilisation is used ;	<b>A</b> in terms of, rate of reaction / production or amount or concentration, of glucose <b>A</b> if choose 2 of the types of immobilisation <b>I</b> 'any difference in the activity of enzymes is due to chance'	[1]
(ii)	the method / way, of immobilising (the enzyme) ;	<b>I</b> 'the immobilisation of the enzyme' unqualified <b>A</b> 'the different types of immobilised enzymes'	[1]
(iii)	<i>idea of</i> using a biosensor to find the concentration of glucose (in a known time) ;	<b>A</b> clinistix / dip sticks / glucose meter / glucose monitor / glucose concentration detector <b>A</b> Benedict's test / permanaganate test, qualified : <i>idea of</i> semi-quantitative / description to compare colours <b>I</b> use of HCl	[1]
(b)	7 of: <i>independent variable:</i> 1. <i>ref. to</i> using, the same (equivalent) / fixed, concentration of, enzyme / lactase ;  <i>dependent variable:</i> 2. <i>ref. to</i> , measuring with biosensor AW / comparing dip sticks <b>or</b> clinistix to colour chart ;  <i>control variables :</i> 3. <i>ref. to</i> , same / fixed, volume of lactose solution ;	1. <b>A</b> known concentration of enzyme. <b>R</b> same mass of immobilised enzyme <b>I</b> volume  2. <b>A</b> Benedict's solution / Benedict's test / permanganate test, qualified by e.g. <i>idea of</i> semi-quantitative / compare colours to standard <b>R</b> <i>ref. to</i> heating with HCl  3. <b>I</b> <i>ref. to</i> using milk	

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<b>Question</b>	<b>Expected answer</b>	<b>Extra guidance</b>	<b>Mark</b>
	<p>4. <i>ref. to</i> method of keeping same temperature (for each enzyme) ;</p> <p>5. <i>ref. to</i> buffer to control pH (at same level for each enzyme) ;</p> <p>6. standardising time (for lactose to be in contact with enzyme) / AW ;</p> <p>7. <i>ref. to</i> method of timing (in context of mp6) ;</p> <p><i>Procedure</i></p> <p>8. <i>ref. to</i> suitable apparatus to set up columns for immobilised enzyme ;</p> <p>9. <i>ref. to</i> (method of) controlling flow rate through enzyme ;</p>	<p>4. e.g. temperature controlled room / environmental chamber / incubator If temp given max 60 °C <b>A</b> water bath <b>I</b> air conditioning.</p> <p>6. e.g. time for all solution to pass through / fixed time for collection of solution that has passed through / solution left in (a closed) column for a fixed time <b>I</b> 'time for, hydrolysis / experiment'</p> <p>7. using stop clock / stop watch / timer. <b>A</b> in context of 'time for hydrolysis'</p> <p>8. <b>A</b> syringe (barrel) / burette / (glass) tube / funnel <b>A</b> use flasks / beakers / AW <b>A</b> from a labelled diagram</p> <p>9. e.g. tubing with adjustable clip / tap, entering or leaving the column. not available if beaker or flask used in mp8 <b>I</b> pour at, same / steady, speed</p>	

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	<p>10. <i>ref. to</i> method of collecting product ;</p> <p><i>reliability</i></p> <p>11. repeat at least 3 times <b>and</b> find mean / identify anomalies ;</p> <p><i>safety:</i></p> <p>12. <i>ref. to</i> named hazard <b>and</b> suitable precaution ;</p>	<p>10. e.g. in a, beaker / flask / container etc. if use beaker or flask in mp8 <b>must</b> have <i>idea of</i> obtaining a separate solution from immobilised enzyme <b>A</b> from a diagram</p> <p>11. <b>A</b> several / AW, repeats <b>A</b> average for mean</p> <p>12. e.g. enzyme / (named) sugar / alginate/ Benedict's reagent, may be, irritant / allergen, <b>and</b> wear gloves / eye protection hot glassware <b>and</b> tongs / gloves if Benedict's test done <b>A</b> low risk experiment <b>I</b> no risk <b>I</b> water and electricity</p>	[max 7]
<b>(c) (i)</b>	<b>(A)</b> 315 <b>and (C)</b> 240 ;		[1]
<b>(ii)</b>	<p>volume of lactose (solution added) ;</p> <p>time ;</p>		[2]

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(d) (i)	<p><i>significant:</i> idea that the (observed) result or difference is caused by another factor / factor other than chance / immobilisation / is not due to chance ;</p> <p><i>P &lt; 0.05:</i> 5% or less than 5% chance / probability that the (observed) result or difference is not significant ;</p> <p>or</p> <p>95 % or more than 95% chance / probability that the (observed) result or difference is significant ;</p>	<p><b>A</b> named immobilisation method(s) as AW for outside factor</p> <p><b>A:</b> there is 1 in 20 chance of the results being not significant <b>ora</b></p> <p><b>R</b> '95% of results are caused by an outside factor' '5% of the results are caused by chance'</p> <p><i>allow 2 marks for :</i></p> <p>5% or &lt; 5% chance / probability that the (observed) result / difference occur by chance</p> <p>or</p> <p>95% or &gt; 95% chance / probability that the (observed) result / difference are caused by an outside effect / not due to chance</p>	[max 2]

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(ii)	(Table 1.1 shows) method <b>A</b> gives the highest (mean) total glucose collected ;  (Table 1. 2) supports as stats. tests shows that the difference between method <b>A</b> and methods <b>B/C</b> is <u>significant</u> ;	<b>A</b> it appears to give a faster rate of reaction / hydrolysis / glucose production  <b>A</b> difference not due to chance	[2]
			<b>[Total: 17]</b>
2 (a) (i)	<i>idea that</i> individual leaves will be different, sizes / (surface) areas ;  <i>idea that</i> can then compare (the plants with covered / uncovered leaves) ;	<b>A</b> some leaves bigger / smaller <b>I</b> <i>ref. to accuracy / standardisation</i>  <b>I</b> 'different starting points' unqualified	[2]
(ii)	add the values per unit area / take total (for all leaves on each type of plant) <b>and</b> divide by, the total number of leaves / 30 ;	<b>A:</b> if calculate mean per plant and then add and divide by 6 / number of plants <b>I</b> surface area calculations	[1]
(b) (i)	3 of: 1. (content of radioactive phosphate is lower in covered leaves) because no photosynthesis ; <b>ora</b>  2. (content of radioactive phosphate is lower in covered leaves) because of lower transpiration ; <b>ora</b>  3. <i>ref to</i> (content of radioactive phosphate is higher in uncovered leaves) as radioactive phosphate / radioactivity is being used to produce organic compounds / named compounds / (named) phosphate containing products of photosynthesis ;  4. (in both radioactivity) increases up to day 3 / initially (after transfer to unlabelled phosphate), as (it / radioactive phosphate) is still being transported (into leaf from rest of plant) ;	1. <b>A</b> little / less photosynthesis <b>A</b> description of photosynthesis.  2. <b>A</b> description of transpiration.  3. <b>A</b> in terms of use in an e.g. ATP / nucleic acid / phospholipid, synthesis.  <b>I</b> splitting of ATP into ADP + iP	

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	<p>5. <i>idea that</i> (after 3 days) plants start to use unlabelled phosphate as proportion of labelled to unlabelled phosphate has dropped ;</p> <p>6. (after 3 days compounds containing) radioactive phosphate have been, moved out by phloem/translocated from the leaves ;</p>	<p>5. <b>A</b> <i>idea of</i> replace labelled with unlabelled</p> <p>6. <b>A</b> transported / carried / taken / moved / AW, out of leaves / to other parts</p> <p><b>I</b> <i>ref. to</i> radioactive decay in mp5 and mp6  <b>I</b> <i>ref. to</i> loss of phosphate to the atmosphere</p>	[max 3]
(ii)	<p>2 of:</p> <p>1. more plants used ;</p> <p>2. more leaves used ;</p> <p>3. more readings per leaf ;</p> <p>4.ref. to finding, s (standard deviation) / <math>S_M</math> (standard error) ;</p>	<p><b>I</b> samples / trials unqualified</p> <p><b>I</b> control with no <math>^{32}\text{P}</math> to account for / eliminate background radiation</p>	[max 2]
(c)	<p>3 of:</p> <p>1. <i>idea of</i> obtaining section of, root / stem / leaf ;</p> <p>2. <i>idea of</i> covering sections with film (to expose to radioactivity) ;</p>	<p>2. <b>R</b> if expose section / leaf / plant AW to X-rays / X-ray crystallography  <b>I</b> <i>ref. to</i> UV / light / gamma rays etc.  <b>A</b> if film applied to, leaf / dissected out tissues / pieces of leaf  <b>I</b> additional description involving microscopes</p>	



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	<p>3. <i>idea of fogging</i> / black spots, show position of / AW, radioactivity / tissue / radioactive tissue / named tissue ;</p> <p>4. <i>idea of comparing</i> / AW, to sections of, root / stem / leaf, to identify tissue (that corresponds to the fogged zones) ;</p>	<p>3. if separate tissues have separate films placed on them then <b>A</b> 'find the film with black spots'</p> <p>4. <b>R</b> if section not taken  <b>A</b> comparison to diagram or photograph  <b>I</b> name of tissue, correct or incorrect</p>	[max 3]
<b>(d)</b>	<p>1. (radioactivity in covered leaves) unchanged / little change as, unaffected by / not exposed to, air movement  <b>or</b>            (radioactivity in covered leaves) unchanged / little change as, transpiration / AW, does not change ;</p> <p>2. (uncovered leaves) radioactivity is lower / radioactivity lost more rapidly due to faster transpiration ;</p>	<p><b>I</b> further explanation</p> <p><b>A</b> idea of no / little transpiration</p> <p>2. <b>A</b> (uncovered leaves) radioactivity higher, initially / up to stated day, because transpiration brings (remaining) labelled phosphate faster</p> <p><b>A</b> (uncovered leaves) lower than / like, covered leaves as (high) winds cause stomata to shut</p> <p><b>A</b> (uncovered leaves) higher as wind encourages more CO<sub>2</sub> exchange so more photosynthesis</p> <p><b>I</b> <i>ref. to</i> loss of phosphate to the atmosphere</p>	2
			<b>[Total: 13]</b>