

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:

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| ; | separates marking points |
| / | alternative answers for the same point |
| R | reject |
| A | accept (for responses correctly cued by the question, or by extra guidance) |
| I | ignore |
| AW | alternative wording (where responses vary more than usual) |
| <u>underline</u> | 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 |

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

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| Question | Expected answer | Extra guidance | Mark |
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| | <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 A water bath I 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 I 'time for, hydrolysis / experiment'</p> <p>7. using stop clock / stop watch / timer. A in context of 'time for hydrolysis'</p> <p>8. A syringe (barrel) / burette / (glass) tube / funnel A use flasks / beakers / AW A 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 I 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 and find mean / identify anomalies ;</p> <p><i>safety:</i></p> <p>12. <i>ref. to</i> named hazard and suitable precaution ;</p> | <p>10. e.g. in a, beaker / flask / container etc. if use beaker or flask in mp8 must have <i>idea of</i> obtaining a separate solution from immobilised enzyme A from a diagram</p> <p>11. A several / AW, repeats A average for mean</p> <p>12. e.g. enzyme / (named) sugar / alginate/ Benedict's reagent, may be, irritant / allergen, and wear gloves / eye protection hot glassware and tongs / gloves if Benedict's test done A low risk experiment I no risk I water and electricity</p> | [max 7] |
| (c) (i) | (A) 315 and (C) 240 ; | | [1] |
| (ii) | <p>volume of lactose (solution added) ;</p> <p>time ;</p> | | [2] |

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| Question | Expected answer | Extra guidance | Mark |
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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 < 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>A named immobilisation method(s) as AW for outside factor</p> <p>A: there is 1 in 20 chance of the results being not significant ora</p> <p>R '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 < 5% chance / probability that the (observed) result / difference occur by chance</p> <p>or</p> <p>95% or > 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 A gives the highest (mean) total glucose collected ; (Table 1. 2) supports as stats. tests shows that the difference between method A and methods B/C is <u>significant</u> ; | A it appears to give a faster rate of reaction / hydrolysis / glucose production A difference not due to chance | [2] |
| | | | [Total: 17] |
| 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) ; | A some leaves bigger / smaller I <i>ref. to accuracy / standardisation</i> I 'different starting points' unqualified | [2] |
| (ii) | add the values per unit area / take total (for all leaves on each type of plant) and divide by, the total number of leaves / 30 ; | A: if calculate mean per plant and then add and divide by 6 / number of plants I surface area calculations | [1] |
| (b) (i) | 3 of: 1. (content of radioactive phosphate is lower in covered leaves) because no photosynthesis ; ora 2. (content of radioactive phosphate is lower in covered leaves) because of lower transpiration ; ora 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. A little / less photosynthesis A description of photosynthesis. 2. A description of transpiration. 3. A in terms of use in an e.g. ATP / nucleic acid / phospholipid, synthesis. I 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. A <i>idea of</i> replace labelled with unlabelled</p> <p>6. A transported / carried / taken / moved / AW, out of leaves / to other parts</p> <p>I <i>ref. to</i> radioactive decay in mp5 and mp6 I <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) / S_M (standard error) ;</p> | <p>I samples / trials unqualified</p> <p>I control with no ^{32}P 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. R if expose section / leaf / plant AW to X-rays / X-ray crystallography I <i>ref. to</i> UV / light / gamma rays etc. A if film applied to, leaf / dissected out tissues / pieces of leaf I 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 A 'find the film with black spots'</p> <p>4. R if section not taken A comparison to diagram or photograph I name of tissue, correct or incorrect</p> | [max 3] |
| (d) | <p>1. (radioactivity in covered leaves) unchanged / little change as, unaffected by / not exposed to, air movement or (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>I further explanation</p> <p>A idea of no / little transpiration</p> <p>2. A (uncovered leaves) radioactivity higher, initially / up to stated day, because transpiration brings (remaining) labelled phosphate faster</p> <p>A (uncovered leaves) lower than / like, covered leaves as (high) winds cause stomata to shut</p> <p>A (uncovered leaves) higher as wind encourages more CO₂ exchange so more photosynthesis</p> <p>I <i>ref. to</i> loss of phosphate to the atmosphere</p> | 2 |
| | | | [Total: 13] |