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Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

9700 BIOLOGY

9700/51 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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Mark scheme abbreviations:

;	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)
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

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Question	Expected answer	Extra guidance	Mark
1 (a) (i)	*independent variable*: free or immobilised enzyme ; *dependent variable*: time to decolourise(methylene blue) ;	**I** type / state of enzyme **A** time to change colour **R** rate	[2]
(ii)	*ref. to* first mixing the enzyme / it with (any) alginate ; *ref. to* then adding (alginate and enzyme) to <u>calcium</u> chloride ; *ref. to* method of dropping mixture (to form beads) ;	**I** any alginate concentrations **A** symbol Ca^{2+} / calcium ions e.g. using syringe or pipette **A** dropper	[3]
(iii)	*idea of* replacing the enzyme by boiled enzyme / water ;	**I** without enzyme unqualified **I** glass beads	[1]
(b)	7 of: *independent variable:* 1. same <u>volume</u> / stated <u>volume</u> of enzyme (for making beads and for testing free enzyme) ; *dependent variable*: 2. *ref. to* suitable equipment for measuring time taken for methylene blue / indicator to decolourise ; *standardised (controlled) variables: max 3* 3. *ref. to* same volume / concentration of methylene blue solution ; 4. *ref. to* same volume of ethanol / alcohol ; 5. *ref. to* same volume NAD ;	1. **I** mass of enzyme 2. e.g. stop clock / stop watch / timer **A** same number / stated number of drops	

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Question	Expected answer	Extra guidance	Mark
	6. *ref. to* method of keeping constant temperature **;**	6. e.g. water bath / temperature controlled room / incubator / environmental chamber **I** air conditioning / room temperature If temperature quoted must be maximum 40 °C	
	7. *ref. to* using buffer + maintaining pH **;**		
	procedure: 8. *ref. to* adding ethanol (and NAD) to both types enzyme using same apparatus **;**	8. e.g. in test-tube / boiling tube / beaker / flask. **R** if pour substrates through for the beads and mix in a beaker / AW for the free enzyme	
	9. *ref. to* temperature equilibration before mixing enzyme and substrate **;**		
	10. correct sequencing so that enzyme or substrate is added last **;**	10. **R** if methylene blue added last	
	reliability: 11. repeat at least 3 times **and** find mean / identify anomalies **;**	11. **A** several / many repeats **A** average for mean	
	safety: 12. *ref. to* suitable hazard **and** precaution / low risk experiment **;**	12. e.g. alcohol flammable and no open flames / methylene blue or enzyme irritant / allergen and gloves **I** allergic or toxic or irritant for NAD / ethanol	[max 7]

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Question	Expected answer	Extra guidance	Mark
(c) (i)	subtract the control values from the raw data ; divide 1 by the time (taken for the methylene blue to become colourless) ;	**A** $\frac{1}{\text{time experimental}} - \frac{1}{\text{time control}} = 2$	[2]
(ii)	shows the spread of data / results from the mean ; indicates the reliability of the data / results or data is reliable as values of *s* are very small / **ora** ;	**R** reliability of the mean **R** accuracy / validity **A** correct data quotes **I** standard deviation is less than one	[max 2]
(d)	*significant:* *idea that* the (observed) result or difference is caused by another factor / factor other than chance / immobilisation / is not due to chance ; $P < 0.05$: 5% or less than 5% chance / probability that the (observed) result or difference is not significant ; or 95 % or more than 95% chance / probability that the (observed) result or difference is significant ;	**A** 1 in 20 chance of the results being not significant **ora** *2 marks for :* 5% or <5% chance / probability that the (observed) result or difference occur by chance or 95% or >95% chance / probability that the (observed) result or difference are caused by an outside effect / not due to chance	[max 2]
			[Total: 19]

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Question	Expected answer	Extra guidance	Mark
2 (a) (i)	1 of: time for which the radioactive phosphate supplied ; total time for experiment / 12 weeks ; the species / type of plant used ;	*List rule applies* **A** how long the wells are left in place **A** time after the removal of the wells / 11 weeks **A** dominant herbaceous species **I** number of plants	[max 1]
(ii)	1 of: concentration of the radioactively labelled phosphate / ^{32}P (solution) ; volume of (radioactive phosphate) solution used ; all organisms sampled at the same time ; same tissue sampled each time for the same organism ; position of wells on the stem ;	**I** size of wells **I** number of samples per organism **A** same time / intervals between sampling	[max 1]
(b) (i)	divide the (radio)activity in the sample by the (bio) mass ;	**A** Geiger counter reading / ^{32}P activity **I** number / amount of phosphate (ions) **I** *ref. to* wet or dry (bio)mass	[1]
(ii)	to enable comparisons to be made ;	**I** valid / reliable / accurate	[1]

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Question	Expected answer	Extra guidance	Mark
(c) (i)	1. *supports*, as increase in radioactivity does not occur until after the increase in primary consumers **;** 2. *does not support*, as no evidence about what is happening to the phosphate **;** 3. *does not support*, as radioactivity increases in other primary consumers from the beginning / these consumers have radioactivity (in tissue) **;** 4. *does not support*, as there is no evidence about transport / phloem **;**	1. **A** increases more slowly than primary consumers **A** as the (activity in) primary consumers rises it also increases in secondary and tertiary consumers **R** secondary and tertiary increase as primary decrease 3. **A** the only way these consumers can contain radioactivity is by eating the treated plants 4. **A** supports as it must go through stem <u>but</u> no evidence for transport / phloem data **A** does not support as it could be transported in the xylem	[4]
(c) (ii)	1 of: 1. **X** / primary consumers must have eaten the treated plant **;** 2. **X** takes in ^{32}P faster **;**	**A X** feeds mostly on treated plants **R** if seasonally or only when wells attached	[max1]

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Question	Expected answer	Extra guidance	Mark
(d)	2 of: 1. *idea of* labelling / using other producer species (one at a time) **;** 2. *idea that* the results from all the different primary consumers should be shown separately **;** 3. *idea that* all the results for the secondary and tertiary consumers should be shown separately **;** 4. include results / data for decomposer organisms **;** 5. include results / data for quaternary consumers **;** 6. carry out again at different times of the year **;**	**A** minimum of one other species / type of plant **I** use a variety of plants **I** repeats and take a mean **I** supplying primary consumers with radioactive phosphate	[max 2]
			[Total: 11]

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