Cambridge Pre-U

Cambridge International Examinations
Cambridge Pre-U Certificate

BIOLOGY (PRINCIPAL) **9790/04**

Paper 4 Practical **For examination from 2016**

SPECIMEN MARK SCHEME

2 hours 30 minutes

MAXIMUM MARK: 80

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of **7** printed pages and **1** blank page.

CAMBRIDGE International Examinations

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The following abbreviations may be used in mark schemes:

/	alternative and acceptable answers for the same marking point
;	separates marking points
allow/accept/A	answers that can be accepted
AVP	any valid point – marking points not listed on the mark scheme but which are worthy of credit
AW/owtte	credit alternative wording / or words to that effect
ecf	error carried forward
ignore/I	statements which are irrelevant – applies to neutral answers
not/reject/R	answers which are not worthy of credit
ORA	or reverse argument
(words)	bracketed words which are not essential to gain credit
words	underlined words must be present in answer to score a mark

Section A

Question	Sections	Indicative material	Mark
1 (a)	MMO Decision making	at least five different concentrations of bile salts ; *could include 0%* control (water) included ; dilutions agree with concentrations chosen ;	[3]
(b)	MMO Decision making	0% / water ; use boiled lipase ;	[2]
(c) (i)	MMO Decision making	*idea of* found end point when blue colour just no longer visible ; indicates when pH decreases to certain level ; as fatty acids neutralise sodium carbonate / AW ;	[3]
(ii)	MMO Collection	temperature within range 50 ± 2 °C at every one of at least three readings ;	[1]
(d)	MMO Collection	at least five results obtained and recorded in seconds ; times vary across tubes so that lower concentrations generally have longer times ; monotonic sequence of times vs. concentration ; replicates and means included ;	
	PDO Recording	data recorded as a <u>single</u> table ; table includes columns for raw data (bile salts concentration, time taken) and calculated values (rate) ; appropriate column headings with units in column headings ; e.g. bile salts concentration (%), time taken (s), rate (s^{-1}) independent variable (bile salts concentration) in left hand column ; results recorded to same degree of precision within each column ;	[7 max]
	ADC Display of calculation and reasoning	rates calculated and given to appropriate significant figures ;	[1]
	MMO Decision making	*accept three separate decisions even if not justified* use of tube without thymolphthalein as colour comparator ; to identify end point ; ref to including bile salts in colour comparator ; as bile salts give colour to milk ; use replicates ; to check on reliability / repeatability ; **R** accuracy / precision AVP ;; e.g. when to start timer	[max 3]

Question	Sections	Indicative material	Mark
(e)	PDO Graph	line graph, bile salts concentration on horizontal axis ; *ecf if time plotted, not rate* axes scaled correctly using at least half the graph paper ; axes titles and units – rate (*ecf* from the table) and concentration ; points plotted accurately ; appropriate line that is not extrapolated beyond highest concentration ; if rate plotted, line starts at the origin ; **R** if broken axis	[5]
(f)	ADC Description of patterns and trends	increase in, <u>rate</u> / activity, with increase in concentration of bile salts ; **A** ref to decrease in time as *ecf* comparative data quote ; *% bile salts and rate/time at two different concentrations* ref to shape, e.g. straight line / exponential / plateau ; ref to anomalous result(s) ; **A** 'no anomalous results'	[max 3]
	ADC Conclusions	bile salts <u>emulsify</u> fats ; bile salts promote formation of micelles ; ref to hydrophilic and hydrophobic ends of each molecule ; increase surface area of, globules / AW ; effectively increase substrate concentration ; lipase can only act on the surface of globules ; not water soluble ; hydrolysis / breakage, of <u>ester</u> bonds ; *release of* fatty acids (and glycerol) ; higher concentration of bile salts results in, more emulsification / higher substrate concentration ; AVP ;	[max 7]

(g) Evaluation of procedures and data		
	Identifying limitations and sources of error	*Suggesting improvements*
repeatability	only one sample per concentration / no repeats / not enough repeats / should have been repeated ;	ref to **at least three** samples, mean / standard deviation / standard error ;
end point / timing	end point difficult to judge ; *so that* end point may not have been the same in each case ; stated problem with timing ; *note that stopwatch should be started before mixing* e.g. times all overestimates as started stop watch before adding lipase rates therefore underestimates ;	use colour standard ; **R** colorimeter ref to improved timing method ; **R** have someone else to start the stopwatch way to slow down the reaction e.g. lower temperature / more milk ; set up separately / staggered start ;
indicator	ref to drops of phenolphthalein being inaccurate / AW ; use set volume of phenolphthalein ; colour changes over a range of pH ;	use, pH meter / pH probe and data logger / more sensitive indicator ; record time to reach constant pH ;
precision in preparation	stated problem with syringe(s) ; **A** air bubbles / precision explained **R** liquid in nozzle ref to, uncertainty / percentage error ;	use, graduated pipette(s) / burette / micropipette ;
temperature	problem with maintaining constant temperature ; data quote from **(c) (ii)** ; rate of reaction / activity, depends on temperature ;	use thermostatically-controlled water bath ;
results	ref to anomalous results ; difficult to identify line of best fit / AW ; ref to, range / error, bars ; not enough intermediate concentrations to determine trend ; not wide enough range of concentrations ;	ref to discard / repeat ; use SD / SE / 95% CI as error bars ; <u>stated</u> intermediate concentrations ; use concentrations of bile salts > 5%
		[10]
		[Total: 45]

Section B

Question	Sections	Indicative material	Mark
2 (a) (i)	PDO Recording	drawing made with clear, complete lines ;	[1]
	MMO Collection	correct outline ; central canal ; outline of grey matter shown appropriately ; *labels* grey matter, white matter ; meninges / AW / connective tissue / blood vessel(s) ; dorsal fissure / ventral fissure / dorsal horn / ventral horn ;	[max 5]
(ii)	ADC Conclusions	size of specimen and drawing recorded to nearest mm and calculation given as image size/actual size ;	[1]
	Display of calculation and reasoning	correct answer given for quoted size with no more significant figure than size with lowest number of significant figure ;	[1]
(b)	PDO Recording	drawing made with clear, complete lines ; drawing shows clear cellular detail of the motor neurone cell body ; *e.g. nucleus, nucleolus, (Nissl) granules / bodies*	[2]
	MMO Collection	*labels* dendron(s) / axon ; nucleus, nucleolus ; (granular) cytoplasm ;	[3]
	ADC Interpretation of data and observations	*annotations* reception of impulses from, sensory neurones / interneurones ; initiating impulses to effectors ;	[2]
	ADC Display of calculation and reasoning	diameter of cell body given with appropriate unit with correct derivation ; *calibration may be given or may already be known – but to gain the mark the calculation showing conversion of eyepiece units to micrometres must be clear* *accept result in mm/m expressed in standard form notation*	[1]

Question	Sections	Indicative material	Mark
(c)	PDO Recording MMO Collection	table with column for features to compare – must be direct comparisons ; *max 2 if not direct comparisons between the two sides of the table* • part of brain vs. entire spinal cord ; • much more folded surface of brain vs. few folds in spinal cord surface ; • larger surface area (to volume ratio) of brain vs. smaller surface area of spinal cord ; • 3 (accept 4) layers in brain vs. 2 layers in spinal cord ; • grey matter of brain multilayered / AW vs. homogeneous grey matter of spinal cord ; • cell bodies concentrated in lower part of grey matter in brain vs. distributed throughout grey matter in spinal cord ; • Purkyne cells / other named cells in brain vs. no such cells in spinal cord ; • AVP (other valid comparisons) ; ;	[1] [max 4]
(d) (i)	PDO Recording	axon / dendron, surrounded by myelin ; myelin formed from layers of membrane ; membrane is rich in (phospho) lipid ; electron dense / AW for appearance in EM ; Schwann / glial, cell ; with, cytoplasm / nucleus ; section is in, intermodal region / AW ; axon is, thin / 500 – 1000 nm diameter ; axon contains, mitochondrion / few organelles ; AVP ; e.g. surrounding fibres / collagen	[max 5]
(ii)	ADC Interpretation of data and observations	myelin is insulator ; tissue fluid excluded from axon membrane ; no action potentials / only occur at nodes ; ref to saltatory conduction of impulses ; high speed ; axon can be thin / thick axons needed for fast conduction in unmyelinated neurones ; *idea that* saves materials and energy as not necessary to maintain extra cytoplasm and channels and pumps in axon membrane in intermodal regions ;	[max 4]
(e)	ADC Interpretation of data and observations	**A** – presynaptic (neurone) ; **B** – postsynaptic (neurone) ; *accept* sensory and motor / interneurone synaptic vesicles in **A** ; contain neurotransmitter ; impulses only travel in one direction across synapses / AW ; synaptic, gap / cleft ; mitochondria, to provide energy ; AVP ;	[max 5]
			[Total: 35]

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