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
<u>words</u>	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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