CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9700 BIOLOGY

9700/53 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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CAMBRIDGE
International Examinations

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Mark scheme abbreviations:

;	separates marking points
/	alternatives answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or extra guidance)
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
ecf	error carried forward
I	ignore
mp	marking point (with relevant number)

Question	Expected answer	Extra guidance	Mark
1 (a)	*any 2 from:* 1 *idea of* difficult to identify the end point / AW ; 2 (because) gel, disappears / falls off / is digested / AW, gradually / AW ; 3 (because) the dye colours the solution / solution becomes, cloudy / murky / AW **or** solution might not be, clear enough / AW ;	*accept ref. to contact lenses as opposed to simulated ones* 1 **A** in context of when all gelatin digested away / plastic becomes transparent / AW ; 2 **A** *idea that* colour fades gradually **A** *idea of* non-uniform removal of gelatin 3 **A** ref. to needing to lift out the plastic (because the dye colours the water)	[max 2]
(b) (i)	*any 3 from:* 1 dilution of, stock solution / 1mg / cm^3 solution, ×10 to give 100μg / cm^3 solution ; 2 ref. to, method of dilution / serial dilution / series dilution / proportional dilution ; 3 ref. to correct volume of **saline** (containing EDTA) **and** of stock solution to give stated subtilisin concentration **and** a volume of 50 cm^3 ; 4 range of 5 concentrations or more stated between 20 μg / cm^3 and 100 μg / cm^3 (allow 0.02 mg / cm^3- 0.1 mg / cm^3) ;	*max 2 if no conversion from mg to μg* 1 **A** other methods of achieving the conversion see hand out 2 **A** use $C_1 V_1 = C_2 V_2$ to make... **or** $M_1 V_1 = M_2 V_2$ **A** simple dilution **A** description of methods written or diagrammatic 3 **A** if correct volume (50 cm^3) achieved once **A** if correct volume achieved by removal after dilution **I** type of concentration units given **R** dilution with water alone 4 range must cover 20 μg / cm^3 and 100 μg / cm^3 but could extend below / above **A** in mg / cm^3 (below 0.02 mg / cm^3 and 0.1 mg / cm^3)	[max 3]

Question	Expected answer	Extra guidance	Mark
(ii)	*solution:* boiled (cleaning) solution / (cleaning / saline) solution without, enzyme / subtilisin A / protease ; *reason:* *idea that* other components of the (cleaning) solution do not, digest / remove / break down the, gelatin / protein / layer **or** it is the, enzyme / subtilisin A, that, digest / remove / break down the, gelatin / protein / layer ;	**I** water alone / immobilised enzyme **A** denatured / inactive, enzyme **A** sodium chloride / NaC*l* (solution) / saline (and EDTA) **I** film alone **I** ref. to removal of colour **A** ref. to, other substances / saline / EDTA, having **no** effect *If water is given as the solution* **A** to show that enzyme, digests gelatin / AW **I** ref. to the **enzyme** having an effect – needs digests, etc. **or** 'lacks the enzyme that digest gelatin' / AW **R** 'it shows the other components do not digest gelatin' / AW	[2]
(c) (i)	*independent*: <u>concentration</u> of, subtilisin / enzyme (solution) ; *dependent:* time for, disappearance / breakdown / removal / AW, of, gelatin / protein / layer / colour (change) **or** rate of, disappearance / breakdown / removal / AW, of, gelatin / protein / layer / colour ;	**I** rate / time, of breakdown unqualified **I** film alone **A** time (for simulated lens) to go transparent	[2]

Question	Expected answer	Extra guidance	Mark
(ii)	*any 6 from:* *independent variable* 1 ref. to using 10 cm^3 of each, enzyme / cleaning solution / AW, concentration in, each pot / all pots ; 2 method of measuring volume ; *dependent variable* 3 incubate the, subtilisin / enzyme, solutions to, equilibrate / reach the test temperature (before adding the simulated contact lens) ; 4 use, stopwatch / timer, to record end point / AW ; s*tandardising variables (max 3):* 5 ref. to method of keeping incubation temperature, constant / controlled ; 6 *idea of* standardising the (coloured) gelatin (thickness / mass / coverage / distribution) ; 7 use of, buffer / named buffer, to keep pH constant / to control pH ; 8 ref. to using same, size / area, of (simulated) contact lens / plastic ;	1 **A** other stated volumes between 7 cm^3–12 cm^3 **A** fixed / same, volume of each concentration used / AW 2 e.g. graduated pipette / syringe / measuring cylinder / burette *filled to line (on the pot) = mp 1 & 2* 3 if incubation time stated minimum value of 2 minutes 4 **I** timing the rate 5 e.g. incubator, water-bath, temperature-controlled room. **I** air conditioning *if temperature given must be 35 °C* 6 **I** concentration / amount / volume 7 If pH stated must be a single value between 7.0–7.5 or the range 7.0–7.5 8 **A** 10 mm × 10 mm pieces or any other sensible size	

Question	Expected answer	Extra guidance	Mark
	safety: 9 ref. to, low risk investigation / hazard **and** suitable safety precaution ; *reliability* 10 ref. to minimum number of replicates and mean ;	9 e.g. allergy / sensitivity / to, enzyme / chemical **and** wearing, goggles / gloves / mask e.g. (chemical) irritant / toxic (chemical) **and** wearing, goggles / gloves / mask **R** no risk/ no safety implications 10 **A** 3 (original plus 2) / several / many, replicates **and** mean. **or** 3 replicates to, identify / remove, anomalies / outliers	[max 6]
(d) (i)	1 axes correctly orientated with labels ; 2 axes have units ; 3 line shows decrease as subtilisin A increases ; time for gelatin / AW to become removed / min 0 concentration of subtilisin A $\mu g/cm^3$ or $\mu g\ cm^{-3}$	1 *x*-axis, concentration of subtilisin A **and** *y*-axis, time for / rate of, gelatin / protein / layer / colour / AW, removal / digestion / breakdown 2 *x*-axis $\mu g / cm^3$ **A** *x*-axis mg / cm^3 **and** y axis s **or** min **or** if rate $mm^2\ s^{-1}$ / AW **A** *x*-axis mol / dm^3 **I** figures on axes 3 **A** linear curve **A** rate plotted against concentration rate for gelatin /AW to become removed / 1/min or 1/s or min^{-1} or s^{-1} or AU 0 concentration of subtilisin A $\mu g/cm^3$ or $\mu g\ cm^{-3}$	[3]

Question	Expected answer	Extra guidance	Mark
(ii)	*idea of:* find the time for the gelatin to disappear (using the cleaning solution) on the *y*-axis and read the concentration from the *x*-axis ;		[1]
		[Total: 19]	
2 (a)	exposure (and non-exposure) to alcohol, before birth / during pregnancy / prenatal ;	**A** in context of baby or mother. **R** concentration / volume of alcohol **I** alcohol unqualified	[1]
(b) (i)	*sensory conduction: max 1 from* 1 pre-natal alcohol exposure / group 1 / first group, is faster at 20 days (than no pre-natal exposure) / AW **ora** **or** pre-natal alcohol exposure / group 1 / first group, is slower at 400 days (than no pre-natal exposure) / AW ; **ora** 2 increase in conduction speed for group 1 between 20 and 400 days is less (than that for group 2) ; **ora** 3 In both groups 1 and 2 sensory neurone conduction speed increases with age ; *motor conduction: max 1 from* 4 pre-natal alcohol exposure / group 1 / first group, is slower at 20 days (than no pre-natal exposure) / AW **ora** **or** pre-natal alcohol exposure / group 1 / first group, is slower at 400 days (than no pre-natal exposure) / AW ; **ora**	*for faster / slower accept AW throughout* 1 specific days need to be given not just 'earlier / later' 2 stated raw speed figures alone are not enough **A** 'increase over the time period is less...' 3 **A** in terms of increases over, the time period / the age period / from 20 days to 400 days / with the days / growth / AW 4 **A** pre-natal alcohol exposure / group 1, is slower (than no pre-natal alcohol exposure / group 2) **ora**	

Question	Expected answer	Extra guidance	Mark
	5 increase in conduction speed between 20 and 400 days is similar for group 1 and group 2 ; 6 In both groups 1 and 2 motor neurone conduction speed increases with age ;	5 raw speed figures must be qualified 6 **A** in terms of increases over, the time period / the age period / from 20 days to 400 days / with the days / growth / AW	[max 2]
(b) (ii)	*max 1 from*: 1 motor conduction is faster than sensory at 20 days, in group 2 / with no pre-natal alcohol exposure **ora** **or** motor conduction slower than sensory at 400 days, in group 2 / with no pre-natal alcohol exposure ; **ora** 2 sensory conduction is faster than motor at 20 days, in group 1 / for pre-natal alcohol exposure **ora** **or** sensory conduction is slower than motor at 400 days, in group 1 / for pre-natal alcohol exposure ; **ora** 3 (conduction speed) increases with age (of the infant) ;	*must be idea of the whole nerve / motor **and** sensory neurones* 1 and 2 specific days needed not earlier / later 3 *mp not awarded if mp3 or mp6 given in **b (i)*** **A** increases over, the time period / the age period / from 20 days to 400 days / with the days / growth / AW	[1]

Question	Expected answer	Extra guidance	Mark
(c)	*most reliable:* group 2 / no pre-natal alcohol exposure, at 400 days, motor (velocity) ; *reason:* the standard deviation is, the smallest / (very) small / least / lowest ;	*mp not awarded if more than one group selected* **A** standard deviation, less than 1 / 0.38 **A** less / lower if qualified **I** standard error	[2]
(d) (i)	there is no overlap in the <u>standard deviations</u> ;	**I** error bars / data / results **A** descriptions of no overlap, e.g. 'ranges of the standard deviations don't have anything in common'	[1]
(ii)	the data, is continuous / has a normal distribution / are comparing (two) means ;	**R** continuous variable / change is continuous	[1]
(iii)	there is no significant difference between the sensory conduction, velocity / speed (of the median nerve), in, group 1 (babies) / babies with pre-natal exposure to alcohol, and, group 2 (babies) / babies with no pre-natal exposure to alcohol ;	**A** the difference in the sensory conduction velocity / speed (of the median nerve), between, group 1 (babies) / babies with pre-natal exposure to alcohol, and, group 2 (babies) / babies with no pre-natal exposure / between the two groups (of babies), to alcohol is not significant **A** there is no significant difference between the, sensory conduction velocity / speed (of the median nerve), between the two groups (of babies) **I** ref. to just nerve conduction – must mention sensory	[1]

Question	Expected answer	Extra guidance	Mark
(e)	*max 2 from:* 1 small sample size ;	**I** ref. to 'some babies not affected' 1 **I** replicate / repeats unqualified, but **A** if explained in terms of sample size. *quoted numbers must be qualified*	
	2 groups 1 and 2 of different sizes ;		
	3 different numbers of males and females in each group ;	3 **A** more females than males **ora** **I** stated figures unqualified	
	4 does not include mothers, who drink less than 32 mg of alcohol / who drink alcohol occasionally ;		
	5 does not include the full age range of mothers / AW ;	5 **A** only has mothers of age 23–25 years / small age range of mothers	
	6 body mass / weight, of the, mothers / babies ;		
	7 medication / illegal drugs , taken by mother during pregnancy ;	7 **A** smoking qualified	
	8 ethnicity of the, mother / baby ;		[max 2]
		[Total: 11]	