

CAMBRIDGE INTERNATIONAL EXAMINATIONS**Cambridge International Advanced Subsidiary and Advanced Level****MARK SCHEME for the May/June 2015 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
/	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)
<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
ecf	error carried forward
I	ignore
mp	marking point (with relevant number)

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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 / 1 mg/cm^3 solution, $\times 10$ to give $100\mu\text{g/cm}^3$ 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 $20\mu\text{g/cm}^3$ and $100\mu\text{g/cm}^3$ (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 $20\mu\text{g/cm}^3$ and $100\mu\text{g/cm}^3$ but could extend below / above A in mg/cm^3 (below 0.02 mg/cm^3 and 0.1 mg/cm^3)	[max 3]

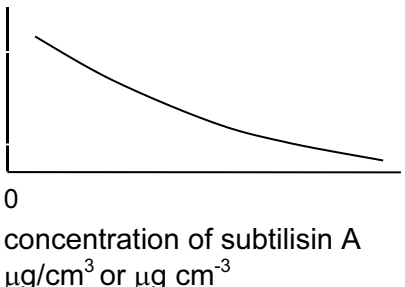
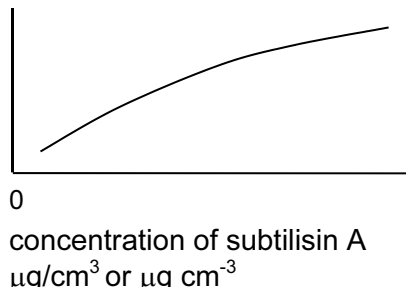
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Question	Expected answer	Extra guidance	Mark
(ii)	<i>solution:</i> boiled (cleaning) solution / (cleaning / saline) solution without, enzyme / subtilisin A / protease ; <i>reason:</i> <i>idea that</i> other components of the (cleaning) solution do 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 / NaCl (solution) / saline (and EDTA) I film alone I ref. to removal of colour A ref. to, other substances / saline / EDTA, having no effect <i>If water is given as the solution</i> A to show that enzyme, digests gelatin / AW I ref. to the enzyme having an effect – needs digests, etc. or R 'it shows the other components do not digest gelatin' / AW	[2]
(c) (i)	<i>independent:</i> <u>concentration</u> of, subtilisin / enzyme (solution) ; <i>dependent:</i> 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]

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Question	Expected answer	Extra guidance	Mark
(ii)	<i>any 6 from:</i> <i>independent variable</i> 1 ref. to using 10 cm³ of each, enzyme / cleaning solution / AW, concentration in, each pot / all pots ; 2 method of measuring volume ; <i>dependent variable</i> 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 ; <i>standardising variables (max 3):</i> 5 ref. to method of keeping incubation temperature, constant / controlled ; 6 <i>idea of</i> 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 cm³–12 cm³ A fixed / same, volume of each concentration used / AW 2 e.g. graduated pipette / syringe / measuring cylinder / burette <i>filled to line (on the pot) = mp 1 & 2</i> 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 <i>if temperature given must be 35 °C</i> 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	

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Question	Expected answer	Extra guidance	Mark
	<i>safety:</i> 9 ref. to, low risk investigation / hazard and suitable safety precaution ; <i>reliability</i> 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 $\mu\text{g}/\text{cm}^3$ or $\mu\text{g cm}^{-3}$	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 $\mu\text{g}/\text{cm}^3$ A x-axis mg/cm^3 and y axis s or min or if rate $\text{mm}^2 \text{s}^{-1}$ / 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 $\mu\text{g}/\text{cm}^3$ or $\mu\text{g cm}^{-3}$	[3]

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Question	Expected answer	Extra guidance	Mark
(ii)	<i>idea of:</i> 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)	<i>sensory conduction: max 1 from</i> 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 ; <i>motor conduction: max 1 from</i> 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	<i>for faster/ slower accept AW throughout</i> 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	

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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)	<i>max 1 from:</i> 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) ;	<i>must be idea of the whole nerve / motor and sensory neurones</i> 1 and 2 specific days needed not earlier / later 3 <i>mp not awarded if mp3 or mp6 given in b (i)</i> A increases over, the time period / the age period / from 20 days to 400 days / with the days / growth / AW	[1]

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Question	Expected answer	Extra guidance	Mark
(c)	<i>most reliable:</i> group 2 / no pre-natal alcohol exposure, at 400 days, motor (velocity) ; <i>reason:</i> the standard deviation is, the smallest / (very) small / least / lowest ;	<i>mp not awarded if more than one group selected</i> 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]

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