

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)	<p>any 2 from:</p> <p>1 idea of difficult to identify the end point / AW ;</p> <p>2 (because) gel, disappears / falls off / is digested / AW, gradually / AW ;</p> <p>3 (because) the dye colours the solution / solution becomes, cloudy / murky / AW or solution might not be, clear enough / AW ;</p>	<p>accept ref. to contact lenses as opposed to simulated ones</p> <p>1 A in context of when all gelatin digested away / plastic becomes transparent / AW ;</p> <p>2 A idea that colour fades gradually A idea of non-uniform removal of gelatin</p> <p>3 A ref. to needing to lift out the plastic (because the dye colours the water)</p>	[max 2]
(b) (i)	<p>any 3 from:</p> <p>1 dilution of, stock solution / 1mg / cm³ solution, ×10 to give 100µg / cm³ solution ;</p> <p>2 ref. to, method of dilution / serial dilution / series dilution / proportional dilution ;</p> <p>3 ref. to correct volume of saline (containing EDTA) and of stock solution to give stated subtilisin concentration and a volume of 50 cm³ ;</p> <p>4 range of 5 concentrations or more stated between 20 µg / cm³ and 100 µg / cm³ (allow 0.02 mg / cm³ - 0.1 mg / cm³) ;</p>	<p>max 2 if no conversion from mg to µg</p> <p>1 A other methods of achieving the conversion see hand out</p> <p>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</p> <p>3 A if correct volume (50 cm³) achieved once A if correct volume achieved by removal after dilution I type of concentration units given R dilution with water alone</p> <p>4 range must cover 20 µg / cm³ and 100 µg / cm³ but could extend below / above A in mg / cm³ (below 0.02 mg / cm³ and 0.1 mg / cm³)</p>	[max 3]

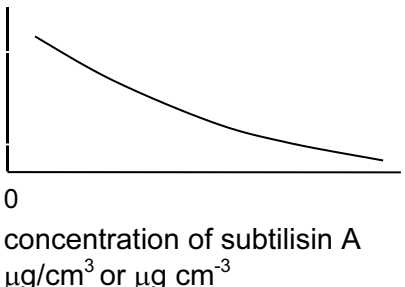
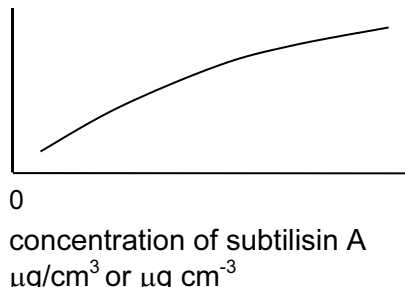
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Question	Expected answer	Extra guidance	Mark
(ii)	<p><i>solution:</i> boiled (cleaning) solution / (cleaning / saline) solution without, enzyme / subtilisin A / protease ;</p> <p><i>reason:</i> <i>idea that other components of the (cleaning) solution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

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Question	Expected answer	Extra guidance	Mark
(ii)	<p>any 6 from:</p> <p><i>independent variable</i></p> <p>1 ref. to using 10 cm³ of each, enzyme / cleaning solution / AW, concentration in, each pot / all pots ;</p> <p>2 method of measuring volume ;</p> <p><i>dependent variable</i></p> <p>3 incubate the, subtilisin / enzyme, solutions to, equilibrate / reach the test temperature (before adding the simulated contact lens) ;</p> <p>4 use, stopwatch / timer, to record end point / AW ;</p> <p><i>standardising variables (max 3):</i></p> <p>5 ref. to method of keeping incubation temperature, constant / controlled ;</p> <p>6 <i>idea of</i> standardising the (coloured) gelatin (thickness / mass / coverage / distribution) ;</p> <p>7 use of, buffer / named buffer, to keep pH constant / to control pH ;</p> <p>8 ref. to using same, size / area, of (simulated) contact lens / plastic ;</p>	<p>1 A other stated volumes between 7 cm³–12 cm³ A fixed / same, volume of each concentration used / AW</p> <p>2 e.g. graduated pipette / syringe / measuring cylinder / burette <i>filled to line (on the pot) = mp 1 & 2</i></p> <p>3 if incubation time stated minimum value of 2 minutes</p> <p>4 I timing the rate</p> <p>5 e.g. incubator, water-bath, temperature-controlled room. I air conditioning <i>if temperature given must be 35 °C</i></p> <p>6 I concentration / amount / volume</p> <p>7 If pH stated must be a single value between 7.0–7.5 or the range 7.0–7.5</p> <p>8 A 10 mm × 10 mm pieces or any other sensible size</p>	

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	<p><i>safety:</i> 9 ref. to, low risk investigation / hazard and suitable safety precaution ;</p> <p><i>reliability</i> 10 ref. to minimum number of replicates and mean ;</p>	<p>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</p> <p>10 A 3 (original plus 2) / several / many, replicates and mean. or 3 replicates to, identify / remove, anomalies / outliers</p>	[max 6]
(d) (i)	<p>1 axes correctly orientated with labels ;</p> <p>2 axes have units ;</p> <p>3 line shows decrease as subtilisin A increases ;</p> <p>time for gelatin / AW to become removed / min</p>  <p>0 concentration of subtilisin A $\mu\text{g}/\text{cm}^3$ or $\mu\text{g cm}^{-3}$</p>	<p>1 x-axis, concentration of subtilisin A and y-axis, time for / rate of, gelatin / protein / layer / colour / AW, removal / digestion / breakdown</p> <p>2 x-axis $\mu\text{g}/\text{cm}^3$ A x-axis mg/cm^3 and y axis s or min or if rate $\text{mm}^2 \text{s}^{-1} / \text{AW}$ A x-axis mol/dm^3 I figures on axes</p> <p>3 A linear curve A rate plotted against concentration</p> <p>rate for gelatin / AW to become removed / 1/min or 1/s or min^{-1} or s^{-1} or AU</p>  <p>0 concentration of subtilisin A $\mu\text{g}/\text{cm}^3$ or $\mu\text{g cm}^{-3}$</p>	[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 <i>y</i> -axis and read the concentration from the <i>x</i> -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)	<p><i>sensory conduction: max 1 from</i></p> <p>1 pre-natal alcohol exposure/group 1 /first group, is faster at 20 days (than no pre-natal exposure) /AW ora</p> <p>or</p> <p>pre-natal alcohol exposure/group 1 /first group, is slower at 400 days (than no pre-natal exposure) /AW ; ora</p> <p>2 increase in conduction speed for group 1 between 20 and 400 days is less (than that for group 2) ; ora</p> <p>3 In both groups 1 and 2 sensory neurone conduction speed increases with age ;</p> <p><i>motor conduction: max 1 from</i></p> <p>4 pre-natal alcohol exposure/group 1 /first group, is slower at 20 days (than no pre-natal exposure)/AW ora</p> <p>or</p> <p>pre-natal alcohol exposure/group 1 /first group, is slower at 400 days (than no pre-natal exposure)/AW ; ora</p>	<p><i>for faster/ slower accept AW throughout</i></p> <p>1 specific days need to be given not just 'earlier /later'</p> <p>2 stated raw speed figures alone are not enough A 'increase over the time period is less...'</p> <p>3 A in terms of increases over, the time period/the age period /from 20 days to 400 days /with the days / growth /AW</p> <p>4 A pre-natal alcohol exposure/group 1, is slower (than no pre-natal alcohol exposure /group 2) ora</p>	

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

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

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