

Question			Answer	Marks	Guidance
1	(a)	(i)	polysaccharide ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT phonetic spelling IGNORE polymer IGNORE oligosaccharide</p>
		(ii)	<p><i>similarity</i> chain / unbranched / glycosidic bonds / (contain) hexose / hex ring / O in each ring / CHO ;</p> <p><i>difference</i> agarose has:</p> <p>two types of (glycosidic) bond</p> <p>or</p> <p>two different, sugars / sugar residues / monosaccharides</p> <p>or</p> <p>disaccharide, monomer / subunit / AW</p> <p>or</p> <p>(residues) are alternately rotated / AW</p> <p>or</p> <p>straight chain ;</p>	2	<p>IGNORE polysaccharides IGNORE 6-carbon ring ACCEPT 5-carbon ring</p> <p>Assume answer refers to agarose unless otherwise stated ACCEPT ora for any point</p> <p>DO NOT CREDIT references to any incorrect bond ACCEPT any suggestion of bonding to different numbered carbon atoms (as numbers are not given in diagram) ACCEPT 'alternating bonds'</p> <p>IGNORE refs to glucose</p> <p>ACCEPT 'flipped' / 'reflected'</p> <p>ACCEPT 'amylose is coiled'</p>

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	(b)	<p>(bacteria) do not, make / have, correct <u>enzyme</u> (to digest agarose) ;</p> <p>agarose, does not fit / not complementary to, <u>active site</u> (of bacterial enzymes) ;</p> <p>bacteria unable to transport , substrate / enzyme , across membrane ;</p>	1 max	DO NOT CREDIT in incorrect context e.g. 'bacteria do not have amylase' or 'bacterial enzyme cannot break down amylose'
	(c)	(i) <u>control</u> ;	2	<p>ACCEPT 'compare it with the other tube'</p> <p>IGNORE 'compare the tubes'</p>
		<p>compare with tube A / see what happened when there was no bacteria / show it was bacteria doing it / to show it does not break down on its own / to show that the nutrient solution does not break it down ;</p>		

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(c)	(i)	<p><i>idea that</i></p> <p>some, starch / other polysaccharide / (reducing) sugar present in , nutrient solution / culture solution / bacteria (at start) ;</p> <p>presence of some mutated , <i>E. coli</i> / bacteria , (that can break it down) ;</p> <p>presence of (other) microorganism that can break it down ;</p>	1 max	<p>IGNORE experimental error unqualified</p> <p>IGNORE any reference to temperature</p> <p>IGNORE other carbohydrate</p>
	(iii)	<p>replicate(s) / repeat(s) ;</p> <p>more than one sample tested from each tube / sample each tube twice ;</p>	2	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE 'do more tests'</p> <p>IGNORE 'disregard anomalous results'</p> <p>IGNORE 'compare with other results'</p> <p>IGNORE 'calculate mean'</p>

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(d)	(i)	<p>1 add, Benedict's (reagent) / $\text{CuSO}_4 + \text{NaOH}$ / alkaline copper sulphate ;</p> <p>2 heat ;</p> <p>3 (forms) <u>precipitate</u> ;</p> <p>4 (colour changes from blue to), green / yellow / orange / brown / (brick) red ;</p> <p><i>concentration estimated from</i></p> <p>EITHER</p> <p>5a degree of colour change / use different colours ;</p> <p>6a comparison (of final colour) with , standard / known, solution ;</p> <p>OR</p> <p>5b filter / centrifuge , and weigh precipitate ;</p> <p>6b greater mass = more sugar present / use of a standard curve ;</p> <p>OR</p> <p>5c centrifuge ;</p> <p>6c size , of pellet / colour of supernatant (liquid), indicates concentration ;</p>	5 max	<p>1 ACCEPT 'do Benedict's test'</p> <p>1 DO NOT CREDIT if adding acid / hydrolysing</p> <p>2 ALLOW boil</p> <p>2 IGNORE warm</p> <p>2 ACCEPT any temperature between 80°C and 100°C</p> <p>2 ACCEPT gently heat</p> <p>Read as prose and mark the best suggestions</p> <p>5/6 DO NOT AWARD if candidate is using a colorimeter</p> <p>5a ACCEPT 'the darker / redder , the more reducing sugar'</p> <p>5a ACCEPT in context of precipitate or supernatant</p> <p>6a Answers must include the idea of comparison</p> <p>6a ACCEPT ref to calibration curve as long as not in context of colorimeter</p> <p>6b ACCEPT weight</p> <p>6b ACCEPT amount</p> <p>6c ACCEPT mass</p>

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	(ii)	<p>1 add (hydrochloric) acid and boil ;</p> <p>2 add, (named) alkali / (sodium) carbonate / (sodium) hydrogencarbonate ;</p> <p>3 <u>then</u> carry out reducing sugar test (again) / described ;</p>	3 max	<p><i>Max 2 if any point out of sequence</i></p> <p>1 CREDIT add hydrolytic enzyme 1 ACCEPT heat</p> <p>2 CREDIT 'neutralise' if not contradicted by named chemical</p>
Total			17	

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2	(a)	<p>1 nucleus / nuclei ;</p> <p>2 other named organelle / membrane bound organelles ;</p> <p>3 linear chromosomes ;</p> <p>4 DNA, associated with / AW, histones / protein ;</p> <p>5 80S / 22nm / large, ribosomes ;</p> <p>6 large cells / AW ;</p> <p>7 no cell wall ;</p>	2 max	<p>Mark the first answer on each prompt line. ACCEPT ora throughout</p> <p>1 ACCEPT 'DNA not free'</p> <p>2 e.g. mitochondria / Golgi / etc 2 ACCEPT compartmentalized organelles 2 ACCEPT don't have a mesosome</p> <p>4 ACCEPT 'DNA not naked'</p>
	(b)	<p>capital letter on, specific name / Vivax ;</p> <p>not italicised / not underlined ;</p>	1 max	<p>Mark the first answer ACCEPT ora for what student should have typed</p> <p>ACCEPT 'the parasite is Plasmodium falciparum / malariae / ovale' if candidate uses capital 'P' and lower case 'f / m / o'</p>
	(c)	(i)		<p>3 max</p> <p>IGNORE references to stages of life-cycle Max 2 if virus / bacterium appears anywhere</p> <p>3 IGNORE case of initial 'P'</p> <p>3 Must be in context of transmission from mosquito to human 4 'blood' can be inferred, e.g. from refs to anticoagulant 4 IGNORE ref to parasite in blood after liver</p>
		<p>1 (mosquito), is <u>vector</u> ;</p> <p>2 <i>Plasmodium</i> / parasite, present in (mosquito), saliva / salivary gland ;</p> <p>3 <i>idea that</i> infected mosquito, feeds on / bites, human ;</p> <p>4 <i>Plasmodium</i> / parasite, passes (from saliva) to blood ;</p>		

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	(c) (ii)	<p>destruction of a species is, morally / ethically, wrong ;</p> <p>might cause unintended health problems in humans ;</p> <p>might harm, other / unintended, species ;</p> <p><i>idea of bioaccumulation / biomagnification ;</i></p>	1 max	<p>Mark the first suggestion</p> <p>IGNORE 'might enter human food' unqualified</p> <p>Answers must imply idea of harm</p>

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(c)	(iii)	<p><i>Field investigation</i></p> <p>F1 (sampling) before and after insecticide treatment ;</p> <p>F2 <i>idea of</i> , unbiased / random, sampling of population ;</p> <p>F3 example of sampling technique ;</p> <p>F4 (sampling in) different, times / weather ;</p> <p>F5 <u>large</u> number of samples taken ;</p> <p>F6 <i>idea of</i> standardised sampling procedure ;</p> <p>F7 <i>idea of</i> preventing counting same individual more than once ;</p> <p>F8 <i>idea of</i> capture – recapture ;</p> <p>F9 calculate mean / calculate standard deviation / apply statistical test ;</p>	5 max	<p>Award marks for either a field or laboratory investigation – must read whole answer before beginning to mark to decide if field or laboratory.</p> <p>If candidates answer in terms of incidence of malaria award no marks as question states population of mosquitoes but read whole question in case mosquito study described in addition.</p> <p>If the investigation is in the both field and laboratory mark the investigation which gives candidate most marks.</p> <p>F1 IGNORE refs to treated and untreated areas as stem refers to ‘a population’</p> <p>F3 e.g. sweep net, pond net, light trap</p> <p>F3 ACCEPT insect net</p> <p>F3 IGNORE ‘net’ or ‘trap’ unqualified</p> <p>F4 IGNORE intervals unqualified. Answers must refer to time or weather</p> <p>F5 Must imply large number or state five or more</p> <p>F6 ACCEPT <i>idea of</i> counting by the same <u>method</u></p> <p style="text-align: right;">Continued.....</p>

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			<p>OR</p> <p><i>Laboratory investigation</i></p> <p><i>idea of:</i></p> <p>L1 with and without insecticide exposure ;</p> <p>L2 measuring mosquito survival / count surviving mosquitoes ;</p> <p>L3 controlling one named key variable ;</p> <p>L4 controlling second named key variable ;</p> <p>L5 <i>idea of using a range of insecticide concentrations ;</i></p> <p>L6 replicates ;</p> <p>L7 calculate <u>mean</u> / calculate standard deviation / apply statistical test ;</p>		<p>Laboratory investigation could be done outside</p> <p>L1 is for changing the independent variable</p> <p>L2 is for measuring the dependent variable ACCEPT count the number of dead ones</p> <p>L3 and L4 <i>award up to 2 marks for</i> exposure time species of mosquito stage of mosquito life cycle sex of mosquito number of mosquitos insecticide type insecticide concentration volume of insecticide temperature</p> <p>L6 Minimum of 3 in total, i.e. original plus two</p> <p>L7 IGNORE average</p>
			Total	12	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	<p>1 sweep netting / sweep vegetation with a net ;</p> <p>2 beating / beat trees and bushes ;</p> <p>3 pooter / pooting / described ;</p>	1 max	<p>2 ACCEPT fogging</p> <p>3 ACCEPT pitfall traps / described</p>
	(a)	(ii)	<p><i>idea of ladybirds</i> not evenly distributed / some parts of hill different / more representative ;</p> <p>lets <u>reliability</u> be assessed / anomalies identified ;</p>	1 max	<p>ACCEPT description e.g. could be more ladybirds one side than another</p> <p>ACCEPT increases reliability IGNORE accuracy / precision / removes anomalies</p>
	(b)	(i)	<p>M1 (calculate) % / proportion / ratio ;</p> <p>E1 as different total numbers at each site ;</p> <p>or</p> <p>M2 (draw) bar chart / kite diagram ;</p> <p>E2 pictorial data easier to understand ;</p>	2 max	<p>M1 IGNORE χ^2</p> <p>M2 IGNORE histogram / line graph</p>

Question		Expected Answers	Marks	Additional Guidance
(b)	(ii)	<p><i>yes (for first statement)</i></p> <p>1 first statement true / correlation exists ;</p> <p>2 number of black ladybirds increase , from 100m to 300m / until 300m ;</p> <p>3 400m number decrease but % black increases ;</p> <p><i>no (for second statement)</i></p> <p>4 correlation not proof of causation / no proof of causal link / second statement not (necessarily) true ;</p> <p>5 another (named) factor could be involved ;</p>	3 max	<p>If candidates argues 'yes' exclusively, can only be awarded mps 1-3</p> <p>If candidate answers 'no' exclusively, can only be awarded mps 4 & 5</p> <p><i>Note percentage of black ladybirds increases as you go up the hill = 2 marks (mps 2 & 3)</i></p> <p>5 CREDIT could be due to distance from town / more or less predation high up / camouflage / warning colours</p>
(c)	(i)	<p>only expressed , when homozygous / in absence of dominant (allele) ;</p> <p>not expressed when heterozygous / expression masked by dominant (allele) ;</p>	1 max	<p>DO NOT CREDIT gene</p> <p>IGNORE letters / genotypes</p> <p>ACCEPT only seen in phenotype when it is present in 'double dose'</p>

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(c)	(ii)	<p>1 $q^2 = 296 / 346$ or $0.85 / 0.855 / 0.86$;</p> <p>2 $q = \sqrt{\text{previous answer}}$ or $0.92 / 0.93$;</p> <p>3 $p = 1 - \text{previous answer}$ or $0.08 / 0.07$;</p>	3	<p>1 DO NOT CREDIT calculation or figure unless it has been indicated as q^2</p> <p>2 ACCEPT ecf</p> <p>3 ACCEPT ecf</p> <p>Note If both p and q are correct = 3 marks <i>If p and q not given to 2 decimal places then penalise 1 mark and then apply ecf</i></p> <ul style="list-style-type: none"> • If the 2 final answers add up to 1 give mp 3, then look for evidence of mps 1 or 2 in the working • If the 2 final answers do not add up to 1, look for evidence of mps 1, 2 & 3 in the working • Award the working mark(s) if method correct, even if subsequent calculation incorrect (e.g. $1 - 0.54 = 0.56$ could get mp 3 for '1 – previous answer' even though 0.56 is the incorrect answer for the calculation) <p><i>e.g. if black allele wrongly assumed to be recessive</i> $q = 0.38$ or $q = \sqrt{0.1445}$ give mp 2 as ecf $p = 0.62$ or $p = 1 - 0.38$ give mp 3 as ecf</p> <p><i>e.g. if answer given as</i> $q = 0.85$ and $p = 0.15$ give mp 3 They will not get mp 1 as they think that $296/346 = q$ (rather than q^2) and so will not square root it so they won't get mp 2</p>
			11	

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4	(a)	(i)	osmosis ;	1	Mark the first answer. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks . DO NOT CREDIT diffusion
		(ii)	fit between (phospho)lipids / through (phospho)lipid (bi)layer ; via, protein <u>channels</u> / protein <u>pores</u> / aquaporins ;	2	DO NOT CREDIT fit through phospholipids (molecules) DO NOT CREDIT carrier proteins – if this is used do not award mp 2 IGNORE transport proteins
	(b)		cell wall ; provides strength / withstands (internal) pressure / prevents cell membrane over expanding / exerts pressure potential ; limits uptake of water ;	2 max	'has a strong cell wall' = 2 marks IGNORE rigidity (of wall), cytoplasm pushes against cell wall ACCEPT stops uptake of water (when turgid)
	(c)	(i)	between –1451 and –1799 ;	1	Ensure figure is a negative number CREDIT a range or single value within this range

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(d)	<p><i>reliable</i></p> <p>R1 observe more pieces of onion (epidermis from each solution) ;</p> <p>R2 count more cells (in each piece of epidermis) ;</p> <p>R3 calculate a mean ;</p> <p>R4 identify / ignore anomalous results ;</p> <p style="text-align: right;">max 3</p> <p><i>accurate</i></p> <p><i>idea of:</i></p> <p>A1 use, more / intermediate, concentrations within existing range / smaller gap between concentrations / closer (concentration) values ;</p> <p>A2 narrower range around 50% plasmolysis / 0.4 - 0.7 mol dm⁻³ / -1120 to -2180 kPa ;</p> <p>A3 take photographs and mark cells as counting ;</p>	<p style="text-align: right;">4 max</p>	<p>DO NOT CREDIT 'repeats' unless qualified ALLOW 'repeat the results / experiment' to indicate more pieces of epidermis</p> <p>IGNORE average</p> <p>ACCEPT outliers for anomalies IGNORE removes / avoids, anomalies</p> <p>IGNORE lack of units</p> <p>ACCEPT examples of values quoted in between original values e.g. 0.25, 0.35, etc. ACCEPT 0.2 and 0.9</p> <p>ACCEPT examples of values if clearly showing application of correct narrower range e.g. 0.45, 0.55 , 0.65 For A2 DO NOT CREDIT quoted values extend beyond correct narrower range e.g. 0.35, 0.55, 0.75</p>
	Total	12	