

Biology

Advanced GCE A2 7881

Advanced Subsidiary GCE AS 3881

Mark Schemes for the Units

June 2008

3881/7881/MS/R/08J

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This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Advanced GCE Biology (7881)

Advanced Subsidiary GCE Biology (3881)

MARK SCHEMES FOR THE UNITS

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2801 Biology Foundation

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

x = incorrect response (errors may also be underlined)
^ = omission mark
bod = benefit of the doubt (where professional judgement has been used)
ecf = error carried forward (in consequential marking)
con = contradiction (in cases where candidates contradict themselves in the same response)
sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Question	Expected Answers	Additional Guidance	Marks
1 (b) (i)	chlorophyll ;		1 max
	bone / teeth ;	Ignore 'healthy' / 'strong'	
	coenzyme / enzyme activator / prosthetic group ;	Ignore vague references to nerve impulses DO NOT CREDIT 'for enzymes' alone	
1 (b) (ii)	phospholipid / membrane / DNA / RNA / nucleotide / NADP / sugar-phosphate backbone / ATP ;	Ignore 'healthy' / 'strong' DO NOT CREDIT 'bilayer' alone DO NOT CREDIT amino acid / triglyceride	1 max
	bone / teeth ;	Ignore 'healthy' / 'strong'	
	AVP ; e.g.phosphorylated sugar (TP / GP / RuBP etc)		
[Total : 6]			

Question	Expected Answers	Additional Guidance	Marks
2 (a)	supply , meets demand / unlimited / adequate / reliable ;	ora for blood ALLOW mass produced	1 max
	less risk of , infection / disease / appropriately named infection / pathogens ;	DO NOT CREDIT ref. to side effects / rejection / blood group matching DO NOT CREDIT ref to 'more effective' DO NOT CREDIT purity	
	fewer , ethical / religious , objections ;	ALLOW a specific eg	
2 (b) (i)	restriction / endonuclease / suitable named e.g. ;	DO NOT CREDIT restrictase / restrictive / helicase	1
2 (b) (ii)	ligase ;	DO NOT CREDIT polymerase / lyase	1
2 (b) (iii)	vector / plasmid / phage / virus ;	ALLOW liposomes / micro-injection DO NOT CREDIT 'bacteria' unless in context of a bacterial plasmid DO NOT CREDIT an answer that includes an incorrect statement	1
2 (c) (i)	oxygen ;	ALLOW ammonia (for making amino acids) DO NOT CREDIT nitrogen / ammonium / carbon dioxide	1

Question	Expected Answers	Additional Guidance	Marks
2 (c) (ii)	kill cells / toxic ;		1 max
	restricts growth / reduces rate of cell division ;		
	enzymes , denatured / inhibited ;	DO NOT CREDIT killed	
	ref. change reaction rate / provides optimum growing conditions / pH decreases to below optimum ;	DO NOT CREDIT 'conditions' without the idea of growth ALLOW the idea of waste taking the system out of optimum growing conditions	
	(waste products will) contaminate / alter , product / factor VIII ;	Ignore 'contamination' unqualified	
prevents build up of pressure ;			
[Total : 6]			

Question	Expected Answers	Additional Guidance	Marks
3 (a) (i)	<u>cell wall</u> ;		1
3 (a) (ii)	B / D ; A ; C ;	Answers need to be in the correct order If a choice of answers given, mark the first answer	3
3 (b) (i)	3.1 or 3.2 or 3.17 or 3.167 or 3.1674 ; ;	Correct answer = 2 marks (Answer <i>should</i> be given to the same number of decimal places.) (Answer does not need to be in the box, units are not required.) If answer incorrect or missing, allow 1 mark if you can see $7 \div 221$ or $100 - 96.9$	2

Question	Expected Answers	Additional Guidance	Marks
3 (b) (ii)	number / percentage , at a particular stage proportional to time spent in that stage / AW ;	Needs to be a clear statement ALLOW ref to speed	
as the cycle continues the time in each stage decreases ;	ALLOW a description of ranking (up to anaphase) rather than a list of figures ALLOW ref to speed		
most of / more / longer / longest , time spent in interphase ;	Must refer to time. Ignore ref to speed (faster / slower) ALLOW ecf from (b)(i), so that if comments relating to time do not correspond to the correct data but are applicable to the candidate's calculation in (b)(i), then they should be credited.		
least amount of / less / shorter / shortest , time spent in , anaphase / telophase ;	Must refer to time. Ignore ref to speed (faster / slower) ALLOW ecf as above		
use of a fig. ;	Stage + number of cells / percentage accurately quoted from the table ALLOW manipulated figures (e.g. interphase is approx 9 times longer than prophase / interphase is approx 30 times longer than anaphase)		
(in interphase) build up energy reserves / replicate DNA / protein synthesis / form organelles or named e.g. ;		3 max	

Question	Expected Answers	Additional Guidance	Marks
3 (b) (iii)	<p>no / less / little , mitosis ;</p> <hr/> <p>cells (not in the root tip) are , differentiated / specialised / elongating ;</p> <hr/> <p>nuclei missed in section ;</p>	<p>ALLOW 'cell division' / 'nuclear division' instead of 'mitosis' (but 'replication' not good enough)</p> <p>ALLOW ora (i.e. mitosis only takes place in , root tip / meristem)</p> <p>Ignore ref to growth</p> <p>DO NOT CREDIT ref to cells being in different stages of the cycle</p> <hr/> <p>ALLOW ref to named specialised cell / tissue (e.g. xylem / phloem)</p> <p>Ignore ref to growth</p>	<p></p> <hr/> <p>2 max</p>
[Total : 11]			

Question	Expected Answers	Additional Guidance	Marks
4 (a)		Looking for processes rather than description	3
	F	<u>transcription</u> ;	
	G	translation ;	
	H	exocytosis / secretion ;	ALLOW reverse pinocytosis
4 (b) (i)	CUC GAG GCU ;	1 mark per row Mark each row independently ALLOW ecf from mRNA to tRNA DO NOT CREDIT a row with any ref to T	2
	GAG CUC CGA ;		
4 (b) (ii)	hormone is , a protein / a polypeptide / composed of a chain of amino acids ;		2 max
	triplet / 3 bases / 3 nucleotides / codon / anticodon , codes for , a specific / a particular / one , amino acid ;	DO NOT CREDIT amino acids formed	
	sequence / order , of , triplets / bases , determines the , sequence (or order) of amino acids / primary structure ;	ignore ref to secondary / tertiary structure etc	
4 (c) (i)	Golgi (body / apparatus / complex) ;	DO NOT CREDIT 'vesicles' / 'Golgi vesicles' alone DO NOT CREDIT smooth ER	1

Question	Expected Answers	Additional Guidance	Marks
4 (c) (ii)	modification / processing ;	ALLOW changing ignore ref to sorting	
	adding carbohydrate(s) / adding sugar(s) / glycosylation ;	ALLOW adding lipid / prosthetic group / forms complex protein with other polypeptides / ref to quaternary structure	
	put <u>into</u> vesicles / 'packaging' (for export) ;	Ignore 'packed' (as it implies compression) Ignore ref to sorting Ignore ref to subsequent fate of product (e.g. transport to membrane) ALLOW 'vesicles form to transport hormone out of cell' (but not 'vesicles transport hormone out of cell' without the additional qualification)	
	concentrates / condenses , product ;		
[Total : 10]			

Question	Expected Answers	Additional Guidance	Marks
5 (a)	using water to break , <u>bond</u> / <u>link</u> ;	ALLOW glycosidic / peptide / ester / condensation bond DO NOT CREDIT hydrogen bond	1
5 (b)	ref high temperature / heat / 100°C ;	DO NOT CREDIT 'heating and cooling' / 'above optimum'	2 max
	enzyme <u>denatured</u> ;	DO NOT CREDIT kill	
	ref. breaking bonds / change in <u>shape</u> of active site / change in 3D structure / change in tertiary structure ;		
	starch / substrate , present / to break down ;		
	different enzyme needed (for carbohydrate) ;		
5 (c)	activity / breakdown of starch , varies / changes , with pH ;	Needs to be a statement	
	at / below , pH 2 or at / above , pH 6 , enzyme not active / enzyme has no affect / enzyme denatured / no substrate broken down / no starch broken down ;	Ignore ref to speed or rate of starch breakdown Ignore ref to starch concentration alone	
	<u>between pH 2 and pH 6</u> , enzyme active / substrate broken down / starch broken down ;	DO NOT CREDIT marking points that refer to temperature	
	from pH 2 to pH 4 / at pH 3 , increased (enzyme) activity / more starch broken down ;	This question may be answered systematically i.e. below pH 2 from pH 2 to 4 from pH 4 to 6 above pH 6	
	pH optimum , between 3 and 5 / at 4 ;		
	from pH 4 to pH 6 / at pH 5 , decreased (enzyme) activity / less starch broken down ;		
	fig. in support ; (any pH and concentration with % or figs manipulated)	so allow the mark once the point has been made completely	

Question	Expected Answers	Additional Guidance	Marks
5 (d)	Structure	6 marks maximum for structure	
		ALLOW marking points if clearly shown on a labelled diagram	
S1	(starch is made up of) amylose <u>and</u> amylopectin ;	DO NOT CREDIT amylase (but only penalise once)	
S2	polymer / polysaccharide ;		
S3	(only) alpha / α – glucose ;	DO NOT CREDIT 'a - glucose' / 'a glucose' / α and β glucose	
S4	glycosidic , bonds / links (between glucose molecules) ;	ALLOW phonetic spelling ALLOW oxygen bridge or labelled on a diagram DO NOT CREDIT glucosidic	
S5	part / amylose , is , unbranched / straight ;		
S6	(amylose / unbranched part is) helix / spiral / coil ;	DO NOT CREDIT α helix	
S7	part / amylopectin , is branched ;		
S8	1 – 6 (glycosidic) bonds / links , where branches occur ;	Carbons must be numbered if accepting from a diagram	
S9	1 – 4 (glycosidic) bonds / links , within amylopectin chains / the only bond present in amylose ;	Carbons must be numbered if accepting from a diagram	[6 max]

Question	Expected Answers	Additional Guidance	Marks
F1	compact ;	ALLOW 'small so does not take up a lot of space' DO NOT CREDIT compacted	
F2	can store a lot in a small space ;		
F3	insoluble / not soluble ;		
F4	will not diffuse out of cell / osmotically inactive / does not affect Ψ ;	ALLOW osmotically inert Ignore 'inert' alone / unreactive	
F5	energy storage ;	DO NOT CREDIT energy source DO NOT CREDIT energy store in animals	
F6	easily hydrolysed / easily broken down / many terminals on amylopectin for enzyme action ;	ALLOW 'quickly' instead of 'easily'	
F7	to give supply of / broken down into , glucose ;		
F8	for , respiration / cellulose production / AW ;	Can be awarded without F7	
5 QWC	Quality of the use and organisation of scientific terms At least 3 of the terms in bold, in the correct context . alpha / α – glucose amylopectin amylose compact glycosidic 1 – 4 1 – 6 hydrolysed insoluble polymer polysaccharide		1
[Total : 16]			

Question	Expected Answers	Additional Guidance	Marks																																								
6 (a)	<table border="1"> <thead> <tr> <th></th> <th>trophic level 1</th> <th>trophic level 2</th> <th>trophic level 3</th> <th>trophic level 4</th> </tr> </thead> <tbody> <tr> <td>carnivore</td> <td></td> <td></td> <td>✓</td> <td>✓</td> </tr> <tr> <td>herbivore</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>omnivore</td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>primary consumer</td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>producer</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>secondary consumer</td> <td></td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>tertiary consumer</td> <td></td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table>		trophic level 1	trophic level 2	trophic level 3	trophic level 4	carnivore			✓	✓	herbivore		✓			omnivore		✓	✓	✓	primary consumer		✓			producer	✓				secondary consumer			✓		tertiary consumer				✓	<p>1 mark for each correct row</p> <p>DO NOT CREDIT a row containing a 'hybrid' tick cross</p> <p>Any tick that has not been clearly crossed out counts as a tick</p> <p>If both ticks and crosses used, ignore the crosses and mark the ticks.</p> <p>ALLOW benefit of doubt (bod) if only crosses are used in the correct places for the ticks. Apply ecf and start awarding marks after two 'correct' rows.</p>	6
	trophic level 1	trophic level 2	trophic level 3	trophic level 4																																							
carnivore			✓	✓																																							
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Question	Expected Answers	Additional Guidance	Marks
6 (b) (i)	<p>light misses plant (altogether) ;</p> <hr/> <p>only certain wavelengths of light can be , absorbed / used / fixed (in photosynthesis) ;</p> <hr/> <p>light reflected by , cuticle / leaf / plant ;</p> <hr/> <p>light misses leaf ;</p> <hr/> <p>light (hits the leaf but) , misses chloroplasts / misses chlorophyll ;</p> <hr/> <p>other limiting factor ;</p> <hr/>	<p>Mark the first on each row.</p> <hr/> <p>ALLOW light hits 'non plant' material or plant shaded by other structures (NOT other plants) e.g. of non plant material might include: rocks / bare earth / buildings (NOT clouds)</p> <hr/> <p>ALLOW cannot use green light</p> <hr/> <p>DO NOT CREDIT reflected by clouds</p> <hr/> <p>ALLOW light hits non photosynthesising part of plant e.g. of non photosynthesising part of the plant might include: (non green) stem / bark / petal / root</p> <hr/> <p>ALLOW light passes straight through leaf</p> <hr/> <p>ALLOW only temperature / CO₂ as examples</p> <hr/>	<p></p> <hr/> <p></p> <hr/> <p></p> <hr/> <p></p> <hr/> <p></p> <hr/> <p></p> <hr/> <p>2 max</p> <hr/>

Question	Expected Answers	Additional Guidance	Marks
6 (b) (ii)	<p>mean value / estimated value ;</p> <p>hard to measure (energy transfer values) ;</p> <p>different (energy transfer value) in different ecosystems ;</p> <p>different (energy transfer value) between different trophic levels ;</p> <p>reason to explain difference in energy transfer between trophic levels ;</p> <p>ref efficiency of digestion ;</p> <p>ref activity / metabolism , of organism ;</p> <p>ref seasonal variation ;</p>	<p>ALLOW 'not very accurate'</p> <p>e.g. larger percentage transfer in aquatic ecosystems</p> <p>Looking for the idea of a comparison between trophic levels rather than a general statement about decreasing energy levels as you progress up a food chain</p> <p>e.g. little energy transferred between producer and primary consumer but more at the next energy transfer</p> <p>Looking for a comparative statement</p> <p>e.g. roots are inaccessible but a bird will eat all of a worm</p> <p>e.g. cellulose / bone / feathers , are relatively undigestible</p> <p>Must include ref to organism</p> <p>e.g. animal movement</p> <p>e.g. animals , run away from predators / chase prey</p> <p>e.g. some animals (use energy to) maintain body temperature</p> <p>e.g. heat loss by an organism</p> <p>DO NOT CREDIT heat loss at a trophic level</p>	<p>3 max</p>
			[Total : 11]

2802 Human Health and Disease

Question	Expected Answers	Additional Guidance	Marks
1 (a) (i)	epithelium / epithelial ;	DO NOT CREDIT squamous epithelium	1
1 (a) (ii)	<p><i>cell A</i> <u>goblet</u> ;</p> <p>produce / secrete / release, mucus ; <i>cell B</i> <u>ciliated</u> (epithelium) ; move / waft, mucus / dust / bacteria / AW ;</p>	<p>DO NOT CREDIT mucus / mucus-secreting, cell CREDIT mucous (neck) DO NOT CREDIT excrete</p> <p>DO NOT CREDIT cilia cell / cilia</p>	4
1 (b)	<p>secretes more mucus / mucus more viscous / AW ;</p> <p>reduces / stops / AW, movement of mucus / cilia ;</p>	<p>idea of <i>more</i> mucus produced DO NOT CREDIT 'more goblet cells' Look for idea of effect on <i>action</i> of cilia. CREDIT paralyses / slows / inhibits / inactivates CREDIT mucus builds up DO NOT CREDIT destroys / clogs / burns / kills / damages, cilia</p>	2

<p>(c)</p> <p>pain in, chest / lungs ;</p> <p>persistent coughing ;</p> <p>shortness of breath / AW ;</p> <p>(nature of) cough changes ;</p> <p>voice becomes hoarse ;</p> <p>blood in sputum / cough up blood / AW ;</p> <p>tiredness ;</p> <p>loss of, weight / appetite ;</p>		<p>DO NOT CREDIT symptoms of emphysema or angina e.g. pain in chest when exercising</p> <p>Look for idea of chronic cough</p> <p>CREDIT permanent or constant (cough)</p> <p>DO NOT CREDIT 'smokers cough' or 'chesty cough'</p> <p>CREDIT breathlessness / difficulty in breathing / wheezing / noisy breathing / low tidal volume</p> <p>CREDIT fatigue / exhaustion / lethargy / lack of energy</p> <p>DO NOT CREDIT apathy</p>	<p>3 max</p>
		[Total: 10]	

Question	Expected Answers	Additional Guidance	Marks																																										
2	<table border="1" data-bbox="241 300 1193 842"> <thead> <tr> <th data-bbox="241 300 443 379">category of disease</th> <th data-bbox="443 300 622 379">Alzheimer's</th> <th data-bbox="622 300 748 379">rickets</th> <th data-bbox="748 300 891 379">measles</th> <th data-bbox="891 300 1048 379">HIV/AIDS</th> <th data-bbox="1048 300 1193 379">CHD</th> </tr> </thead> <tbody> <tr> <td data-bbox="241 379 443 451">mental</td> <td data-bbox="443 379 622 451"></td> <td data-bbox="622 379 748 451"></td> <td data-bbox="748 379 891 451"></td> <td data-bbox="891 379 1048 451"></td> <td data-bbox="1048 379 1193 451"></td> </tr> <tr> <td data-bbox="241 451 443 531">infectious</td> <td data-bbox="443 451 622 531"></td> <td data-bbox="622 451 748 531"></td> <td data-bbox="748 451 891 531">✓</td> <td data-bbox="891 451 1048 531">✓</td> <td data-bbox="1048 451 1193 531"></td> </tr> <tr> <td data-bbox="241 531 443 611">degenerative</td> <td data-bbox="443 531 622 611"></td> <td data-bbox="622 531 748 611"></td> <td data-bbox="748 531 891 611"></td> <td data-bbox="891 531 1048 611">✓</td> <td data-bbox="1048 531 1193 611">✓</td> </tr> <tr> <td data-bbox="241 611 443 691">physical</td> <td data-bbox="443 611 622 691"></td> <td data-bbox="622 611 748 691">✓</td> <td data-bbox="748 611 891 691">✓ ;</td> <td data-bbox="891 611 1048 691">✓ ;</td> <td data-bbox="1048 611 1193 691">✓</td> </tr> <tr> <td data-bbox="241 691 443 770">inherited</td> <td data-bbox="443 691 622 770"></td> <td data-bbox="622 691 748 770"></td> <td data-bbox="748 691 891 770"></td> <td data-bbox="891 691 1048 770"></td> <td data-bbox="1048 691 1193 770">(✓) ;</td> </tr> <tr> <td data-bbox="241 770 443 842">deficiency</td> <td data-bbox="443 770 622 842"></td> <td data-bbox="622 770 748 842">✓ ;</td> <td data-bbox="748 770 891 842"></td> <td data-bbox="891 770 1048 842"></td> <td data-bbox="1048 770 1193 842"></td> </tr> </tbody> </table>	category of disease	Alzheimer's	rickets	measles	HIV/AIDS	CHD	mental						infectious			✓	✓		degenerative				✓	✓	physical		✓	✓ ;	✓ ;	✓	inherited					(✓) ;	deficiency		✓ ;				<p data-bbox="1357 308 1872 339">Crossed out tick to be treated as 'blank'</p> <p data-bbox="1357 858 1637 890">one mark per column</p>	4
category of disease	Alzheimer's	rickets	measles	HIV/AIDS	CHD																																								
mental																																													
infectious			✓	✓																																									
degenerative				✓	✓																																								
physical		✓	✓ ;	✓ ;	✓																																								
inherited					(✓) ;																																								
deficiency		✓ ;																																											
2 (b) (i)	passed on in genes (from parent) / AW ;	<p data-bbox="1357 962 2011 1042">must mention genes / DNA / chromosomes / allele and <i>idea</i> of 'parent to child'</p> <p data-bbox="1357 1058 1877 1090">DO NOT CREDIT 'in gametes' (on own)</p>	1																																										
2 (b) (ii)	<p data-bbox="241 1169 730 1201">does not know if he has the disease ;</p> <p data-bbox="241 1265 752 1297">could pass disease / gene, on to child ;</p> <p data-bbox="241 1313 853 1345">may not be able to support / care for, children ;</p>	<p data-bbox="1357 1169 1989 1233">must imply <i>his</i> lack of <i>knowledge</i> whether he will get the disease</p> <p data-bbox="1357 1249 1910 1313">DO NOT CREDIT 'he may still develop the disease'</p> <p data-bbox="1357 1329 1787 1361">Ignore ref. to 'recessive' / 'carrier'</p>	2 max																																										

Question	Expected Answers	Additional Guidance	Marks
2 (c)	<p>ref to stress caused by positive result / relief of stress from negative result ;</p> <p><i>advantages</i></p> <p>screen embryo / diagnose disease early / before symptoms show ; treat person / disease, early / before symptoms appear / AW ; chance to carry out gene therapy / described ;</p> <p>allow termination / abortion / AW ; fewer people will have that disease ; informs decision making (e.g. about whether to have children) ; enables change in lifestyle / take preventative action (to delay onset of disease) ;</p> <p><i>disadvantages</i></p> <p>genetic underclass / ref to prejudice / AW ; discrimination / abuse of knowledge, by employers / insurance companies / banks / medical profession ; ref. to privacy of information ; inaccuracy of testing ; allow termination / abortion / AW ; discourages people from having children ;</p>	<p>Credit once either advantage or disadvantage</p> <p>DO NOT CREDIT 'may not want to know if have gene'</p> <p>DO NOT CREDIT development of drug to target disease / ref to curing disease</p> <p>DO NOT CREDIT refs to genetic engineering / designer babies, etc.</p> <p>CREDIT allows people to prepare for, the future / child care</p> <p>DO NOT CREDIT ref to economic factors</p> <p>e.g. increased number of terminations / moral / psychological / social issues</p>	4 max
			[Total: 11]

Question	Expected Answers	Additional Guidance	Marks
3 (a) (i)	vitamin(s) ;		1
(a) (ii)	carbohydrate(s) ;	(a) (ii) and (b) (i) - responses to come from list in table	1
3 (b) (i)	carbohydrate(s) ; fat(s) ; protein(s) ;	DO NOT CREDIT sugars / starch CREDIT lipids as alternative to 'fat(s)'	2 max
(b) (ii)	anorexia (nervosa) / bulimia ;	CREDIT suitable example of a deficiency disease e.g. scurvy / xerophthalmia / osteomalacia / anaemia DO NOT CREDIT rickets / Kwashiorkor	1
3 (c) (i)	average quantity of, energy / nutrient, to meet needs / to maintain good health ; quantity of, energy / nutrient that satisfies 50% of the population ;	CREDIT named nutrient / required as 'meet needs' CREDIT ref. to balanced diet for 'good health' CREDIT exceeds for 'satisfies'	1 max
(c) (ii)	look up / identify / use, her EAR ; suggest energy intake, below / less than , EAR / 9 – 9.2 MJ day^{-1} ;	CREDIT idea that he has selected her EAR DO NOT CREDIT energy intake <i>same as</i> EAR Must use units DO NOT CREDIT 'about' 9 – 9.2 MJ day^{-1} DO NOT CREDIT 'eat at EAR <u>or</u> less' CREDIT any figure quoted below 9 MJ day^{-1}	2
3 (d)	EAR rises ; energy needed for, development / growth, of fetus ; AVP ; e.g. growth of additional maternal tissue / colostrum / antibody production / mother carrying extra weight	must state what extra energy is used for – not just 'for fetus' CREDIT 'baby' as alternative to 'fetus' CREDIT tissues as breast / blood / fat / uterus DO NOT CREDIT refs to milk / breast feeding	2 max
			[Total: 10]

Question	Expected Answers	Additional Guidance	Marks
4 (a)	<p>small number of cells in sample / only one sample / only one person sampled ;</p> <p>only one person counting / subjective / may not see all parasites ;</p> <p>may be early stage of infection / don't know how long person has been infected ;</p>	<p>mark for ref. <i>sampling</i> (limited / poor)</p> <p>CREDIT 'need to take an average' infers only one sample</p> <p>mark for idea of <i>accuracy</i> of counting</p> <p>mark for idea of stage in infection cycle</p> <p>CREDIT 'different people may have different numbers of red blood cells affected'</p>	2 max
(b) (i)	<p>space taken up by parasites / less space for haemoglobin (in the red blood cells) ;</p> <p>haemoglobin, used / consumed / eaten, by parasites ;</p>	<p>DO NOT CREDIT haemoglobin, destroyed / removed</p> <p>DO NOT CREDIT red blood cells bursting / killed / decreased surface area</p> <p>CREDIT ref to protein in rbc as ref to haemoglobin</p>	1 max
(b) (ii)	<p>fewer (normal) red blood cells / red blood cells misshapen ;</p> <p>less oxygen transported in blood ;</p> <p>oxygen needed for, <u>aerobic</u> respiration in / contraction of, muscles ;</p>	<p>DO NOTCREDIT ref to haemoglobin</p> <p>CREDIT uptake in lungs / delivery to muscles</p>	2 max

Question	Expected Answers	Additional Guidance	Marks
(c)	<p>(female) <i>Anopheles</i> mosquito ; sucks blood from infected person ; parasite in, saliva / salivary glands ; (mosquito) sucks blood from uninfected person ; injects, saliva / anticoagulant, to stop blood clotting ; reference to other means of transmission ;</p> <p style="text-align: right;">3 max</p> <p><i>penalise only once if candidate uses virus / bacteria / disease</i> <i>Pathogen / parasite / Plasmodium :</i> mutates / antigenic shift / antigenic drift / antigens change ; develops resistance to, anti-malarial drugs / named drug / antibiotics ; different, species / types / strains ; complex life cycle / different stages in body / two hosts ; different antigens (at different stages / in different strains) ; hides inside host cells / antigenic concealment ; difficult for immune system to reach ; eukaryotic ; many, genes / antigens ; not easily recognised as foreign ;</p> <p>(effective) vaccine difficult to develop ; humans / animals, act as reservoirs ; symptomless carriers / remains dormant / long incubation period ;</p> <p>hard to eradicate / difficult to destroy all, mosquitoes ; mosquitoes develop resistance to insecticide ; cannot remove all, mosquito breeding grounds / standing water ; climate change increasing range (of mosquito) ; ref, international travel / migration ;</p> <p>qualified ref to economic / political / educational status of countries where malaria is common ; qualified ref to poverty of individuals ;</p> <p style="text-align: right;">5 max</p>	<p>CREDIT bites infected person CREDIT takes blood meal / feeds on blood must imply <i>uninfected</i> person DO NOT CREDIT injects saliva alone e.g. blood transfusions, sharing needles</p> <p><i>Note the marks are for explaining why it is difficult to eradicate rather than for describing how to eradicate</i> DO NOT CREDIT pathogen develops immunity DO NOT CREDIT strands / 4 strains of pathogen</p> <p>CREDIT no vaccine / no effective vaccine</p> <p>DO NOT CREDIT animals transport parasite</p> <p>CREDIT difficulty covering all water with oil e.g. govt. / country can't develop vaccine / provide drugs / poor primary health care / lack of health education e.g. people can't afford, nets / insect repellants / insecticides / drugs</p>	<p style="text-align: right;">7 max</p>
	QWC – legible text with accurate spelling, punctuation and grammar;	this mark should be relatively easy to achieve	1
[Total: 13]			

Question	Expected Answers	Additional Guidance	Marks
5 (a)	bone marrow ; plasma (cell) / effector (cell) ; antibody / immunoglobulin / IgG ;		3
5 (b)	antigens ;		1
5 (c) (i)	P ;		1
(c) (ii)	provide, long-term immunity / immunological memory ; remain in, body / blood / lymph nodes, after infection / AW ; produce, plasma cells / secondary response / faster response, (when re-infected) ;	DO NOT CREDIT 'to remember the antigen / pathogen'	1 max
5 (d) (i)	no Z in blood until day, 5 / 6 ; concentration rises <i>quickly</i> / AW ; maximum concentration, at day 20 (A 19 – 21) / of 7.5 <u>au</u> (A 7 – 8 <u>au</u>) ; then falls <i>slowly</i> ; to about 2 <u>au</u> at day 60 (A 59-60) ;	CREDIT rapidly / steeply / steep gradient / faster (than fall) CREDIT maximum concentration if described as 'increase followed by decrease' but must have units CREDIT '40 days after peak' instead of 60 days DO NOT CREDIT 'units' for au	3 max

(d)	(ii)	<table border="1"> <tr> <td>natural passive immunity</td> <td></td> </tr> <tr> <td>natural active immunity</td> <td></td> </tr> <tr> <td>artificial passive immunity</td> <td></td> </tr> <tr> <td>artificial active immunity</td> <td>✓ ;</td> </tr> </table>	natural passive immunity		natural active immunity		artificial passive immunity		artificial active immunity	✓ ;	<p>No mark if more than one box ticked</p> <p>Crossed out tick to be treated as 'blank' if there is another tick</p> <p>If crossed out tick is the only response then mark this tick</p>	1
			natural passive immunity									
natural active immunity												
artificial passive immunity												
artificial active immunity	✓ ;											
[Total: 10]												

Question	Expected Answers	Additional Guidance	Marks
6 (a)	increases / AW ; aerobic ; lactate / lactic acid ; liver ; debt ; (aerobic) fitness ;	R deficit CREDIT 'dept'	6
			[Total: 6]

2803/01 Transport - Written Paper

Question	Expected Answers				Additional Guidance	Marks
1 (a)		cell A	cell B	cell C	<p>(1) only accept these named examples</p> <p>(2) DO NOT CREDIT incorrectly qualified epithelia e.g. columnar,</p> <p>(2) DO NOT CREDIT just squamous alone</p> <p>(3) DO NOT CREDIT uptake or diffusion of gases / carries or contains haemoglobin / oxyhaemoglobin / provides oxygen</p>	4
	name of cell	(1) phagocyte / neutrophil / granulocyte ;	(2) (squamous) epithelial / epithelium / endothelial / endothelium ;			
	function of cell			(3) transports, oxygen / carbon dioxide / gases ;		
	maximum diameter / μm	(4) any value between 6 and 9 inclusive ;				

Question	Expected Answers	Additional Guidance	Marks																									
1 (b)	<p>one mark for an advantage and one mark for a disadvantage</p> <p><i>advantage</i></p> <ol style="list-style-type: none"> more space / volume for, haemoglobin / oxygen ; <i>idea that</i> rbc's can change shape, to fit through capillaries ; thinner so short diffusion distance / AW ; <i>idea that</i> all metabolic effort is for oxygen carriage / AW ; increases surface area : volume ratio for, (increased) gas exchange / diffusion of gas / named gas ; <p><i>disadvantage</i></p> <ol style="list-style-type: none"> cannot carry out, protein synthesis / replication / repair / division / mitosis / multiplication / self-replacement ; short life span ; 	<p>Take the first advantage or disadvantage given</p> <p><i>advantage</i></p> <ol style="list-style-type: none"> ACCEPT "more room for" <p>5. surface area : volume ratio must be linked to gas exchange etc DO NOT CREDIT general statements like "large surface area to carry oxygen"</p> <p><i>disadvantage</i></p> <ol style="list-style-type: none"> DO NOT CREDIT does not carry out any other functions / ref to general metabolism unqualified / vague ideas about general cell activities / no DNA / no control / exit entry uncontrolled / 	2 max																									
1 (c)	<table border="1" data-bbox="250 959 1346 1353"> <thead> <tr> <th data-bbox="250 959 651 1062">statement</th> <th data-bbox="651 959 817 1062">plasma</th> <th data-bbox="817 959 1010 1062">tissue fluid</th> <th data-bbox="1010 959 1155 1062">lymph</th> <th data-bbox="1155 959 1346 1062">cytoplasm of red blood cells</th> </tr> </thead> <tbody> <tr> <td data-bbox="250 1062 651 1131">contains haemoglobin</td> <td data-bbox="651 1062 817 1131">x</td> <td data-bbox="817 1062 1010 1131">x</td> <td data-bbox="1010 1062 1155 1131">x</td> <td data-bbox="1155 1062 1346 1131">✓ ;</td> </tr> <tr> <td data-bbox="250 1131 651 1206">contains water</td> <td data-bbox="651 1131 817 1206">✓</td> <td data-bbox="817 1131 1010 1206">✓</td> <td data-bbox="1010 1131 1155 1206">✓</td> <td data-bbox="1155 1131 1346 1206">✓ ;</td> </tr> <tr> <td data-bbox="250 1206 651 1281">contains antibodies</td> <td data-bbox="651 1206 817 1281">✓</td> <td data-bbox="817 1206 1010 1281">✓</td> <td data-bbox="1010 1206 1155 1281">✓</td> <td data-bbox="1155 1206 1346 1281">x ;</td> </tr> <tr> <td data-bbox="250 1281 651 1353">in direct contact with muscle cells</td> <td data-bbox="651 1281 817 1353">x</td> <td data-bbox="817 1281 1010 1353">✓</td> <td data-bbox="1010 1281 1155 1353">x</td> <td data-bbox="1155 1281 1346 1353">x ;</td> </tr> </tbody> </table>	statement	plasma	tissue fluid	lymph	cytoplasm of red blood cells	contains haemoglobin	x	x	x	✓ ;	contains water	✓	✓	✓	✓ ;	contains antibodies	✓	✓	✓	x ;	in direct contact with muscle cells	x	✓	x	x ;	<p>Mark by line across</p> <p>If no crosses included in whole table assume blanks are X</p> <p>If there are some crosses and some blanks assumes blanks are undecided and DO NOT CREDIT any lines with blanks</p> <p>DO NOT CREDIT the hybrid tick cross</p> <p>ACCEPT alternative symbols e.g. hyphen for a cross provided it is used consistently</p>	4
statement	plasma	tissue fluid	lymph	cytoplasm of red blood cells																								
contains haemoglobin	x	x	x	✓ ;																								
contains water	✓	✓	✓	✓ ;																								
contains antibodies	✓	✓	✓	x ;																								
in direct contact with muscle cells	x	✓	x	x ;																								
			[Total: 10]																									

Question	Expected Answers	Additional Guidance	Marks
2 (a)	1. rapid increase (in mass / weight) at first / AW ; 2. (then), slower increase / steady increase / AW ; 3. figure ref. to inflection point / AW ; 4. figure ref. at 24 hours / from inflection to end ;	Regard comments about 2cm cubes as NEUTRAL 1 & 2. Increases rapidly and then more slowly = 2 marks. Faster rate then slower rate = 2 marks. Steady increase then slower = 2 marks. 3. ACCEPT ref to time between 3.5 – 5 hours OR % ref between 10 – 11% ACCEPT just over 10 4. Figure from 16.2 – 16.8 inclusive / 6 -7% from after inflection / percentages add up to 16.2 - 16.8	3 max
2 (b)	1. lower / more negative, water potential / Ψ of, potato/ cells / cubes ; ora 2. (potato) / (cells) contain, solutes / salts / ions / sugars / osmotically active substances ; 3. (water enters) by osmosis ; 4. down / with water potential / Ψ gradient / described (from high to low) ; 5. through the partially permeable membrane(s) ;	1. ora = higher water potential / Ψ , in water. Ref to water potential / Ψ MUST be comparative 2. DO NOT CREDIT starch / nutrients / other substances, ACCEPT ref to high solute potential in cells 3. Osmosis mark must be in context with water moving in / potato gaining mass. ACCEPT water osmoses in 4. DO NOT CREDIT "along" 5. ACCEPT differentially / selectively, DO NOT CREDIT semi	3 max
2 (c)	<i>Assume answers are for 1cm cube unless stated as 2cm cube. ora for 2cm cube throughout mark scheme</i> 1. greater surface area : volume ratio ; 2. 6 :1 not 3 :1 ; 3. greater / AW, surface / area for, diffusion / osmosis ; 4. (therefore) <u>more</u> / <u>AW</u> water enters ;	IGNORE references to diffusion distances 1. DO NOT CREDIT 1cm cube has lower volume : surface area. Ref to surface area : volume ratio must be comparative 3. Greater could be comparative figures i.e. 48 v 24 – needs correct units cm^2 if only figures given. 4. Only award if linked to idea of large surface area and clearly implies greater water uptake	2 max
			[Total: 8]

Question		Expected Answers	Additional Guidance	Marks
3	(a)	A pulmonary <u>artery</u> ; B vena cava ;	ALLOW BOD for 'phonetic' spelling e.g. pulmonery, plumonary, polmonery vena carver, veina cava All qualifications to vena cava are neutral e.g. inferior, superior, posterior	2
3	(b)	75 ;		1
	(c) (i)	1. atria pump (blood), short(er) distance / with gravity / ora for ventricles ; 2. atria pump (blood) to ventricles / ventricles pump (blood) to body / to lungs ;	i.e. one distance / gravity mark and another for destination 2. DO NOT CREDIT ref to cells, individual organs and tissues	
	(c) (ii)	right ventricle pumps, shorter distance / to lungs ; ora for left ventricle	ACCEPT correct refs to pulmonary & systemic	3

Question	Expected Answers	Additional Guidance	Marks
3 (d)	<p>X</p> <ol style="list-style-type: none"> 1. atria contract / atrial systole ; 2. blood (passes) into ventricles ; 3. via, atrioventricular / AW, valves ; <p>Y</p> <ol style="list-style-type: none"> 4. ventricles contract / ventricular systole ; 5. blood into, arteries / named artery or arteries ; 6. via (open), semilunar / AW, valves ; 7. atrioventricular / AW, valves shut to prevent backflow ; 8. blood (starts to) enter atria (via veins) ; <i>may appear under Z</i> <p>Z</p> <ol style="list-style-type: none"> 9. relaxation / diastole, (of ventricles and atria) ; 10. semilunar / AW, valves shut to prevent backflow ; <i>may appear under X</i> 11. atrioventricular / AW, valves open ; 12. (passive) filling of ventricles ; 	<p>Treat electrical activity as neutral</p> <ol style="list-style-type: none"> 1. ACCEPT auricles, DO NOT CREDIT ref atria push / squeeze / pump 3. ALLOW correct use of bicuspid / mitral <u>and</u> tricuspid. AV = atrioventricular. DO NOT CREDIT arterioventricular 4. DO NOT CREDIT ref ventricles push / squeeze / pump 6. Allow correct use of pulmonary & aortic valve 7. Correct reason why valves shut is needed i.e. to prevent backflow. ecf from point 3. DO NOT CREDIT this point if it appears before point 4 8. DO NOT CREDIT blood 'enters heart' 9. ACCEPT cardiac / heart <u>muscle</u> relaxes, DO NOT CREDIT 'heart relaxes' 10. Needs reason i.e. prevent backflow – DO NOT apply ecf from point 7 12. ACCEPT rapid filling phase, DO NOT CREDIT filling of "heart" 	6 max
3 (d)	<p>QWC – clear well organised using specialist terms ;</p> <ul style="list-style-type: none"> • Starts description at stage of atrial contraction • Do not award if left and right hand sides are treated sequentially or if sequence is difficult to follow or in wrong order • Uses three specialist terms in correct context – one taken from each of the rows below: <p>Atria / atrial / atrium ventricle(s) / ventricular systole diastole atrioventricular or bicuspid / mitral & tricuspid (NOT AV) semi lunar or aortic & pulmonary (valves)</p>		1
			[Total: 13]

Question	Expected Answers	Additional Guidance	Marks
4 (a)	<p>E guard cell(s) ;</p> <p>F xylem vessel (element) ;</p>	<p>F ACCEPT xylem / tracheid. DO NOT CREDIT xylem tissue</p>	2
(b)	<p>1. carbon dioxide absorption / oxygen release ;</p> <p>2. (carbon dioxide) needed / (oxygen) produced in photosynthesis ;</p> <p>3. ref. to (open) stomata ;</p> <p>4. large surface area in the mesophyll ;</p> <p>5. ref. to low carbon dioxide concentration in atmosphere (so need large surface area) ;</p> <p>6. (mesophyll) surfaces are moist ;</p> <p>7. ref. to water potential / Ψ / diffusion, gradient for water vapour (out of leaf) ;</p>	<p>Many candidates give superb answers on transpiration here, be careful you are not awarding for part c answers here.</p> <p>1. REJECT just carbon dioxide / oxygen exchange</p> <p>2. IGNORE refs to respiration</p> <p>3. DO NOT CREDIT ref to guard cells on their own</p> <p>4. DO NOT CREDIT surface area of leaves (look for internal area)</p>	3 max
(c)	<p>1. transpiration / evaporation ;</p> <p>2. sets up a water potential / Ψ, gradient (anywhere) ;</p> <p>3. (results in) the water in the (leaf) xylem being put under tension / AW ;</p> <p>4. cohesion of water molecules / hydrogen bonding between water molecules ;</p> <p>5. mistletoe / parasite, xylem linked to tree xylem / AW ;</p> <p>6. so water pulled / drawn, up xylem / from tree / AW ;</p> <p>7. mistletoe xylem increases surface area ;</p>	<p>1. a free standing mark – showing evaporation / transpiration is involved, DO NOT CREDIT ref to transpiration stream</p> <p>2. DO NOT CREDIT water potential / Ψ, gradient in roots – location, stem or leaf needs to be implied</p> <p>3. ACCEPT ref to lower <u>hydrostatic</u> pressure at the top or higher at bottom. DO NOT CREDIT unqualified pressure gradient</p> <p>4. DO NOT CREDIT water travels by ‘cohesion tension theory’</p> <p>5. Ref. to xylem is needed for mark. Needs idea of physical contact between parasite xylem and tree xylem. E.g. mistletoe roots into tree xylem = 0 marks.</p> <p>6. DO NOT CREDIT sucks / travels</p>	4 max
			[Total: 9]

Question	Expected Answers	Additional Guidance	Marks
5 (a)	J ; A ; G ; B ; E ;		5 max
			[Total: 5]

2803/03 Practical Examination

Planning Exercise

The mark scheme for the planning exercise is set out on page 4. The marking points **A** to **T** follow the coursework descriptors for Skill P.

Further guidance on the application of the marking points is given on page 5.

Indicate on the plans where the marking points are met by using a tick and an appropriate letter.

There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

Practical Test

Pages 6 to 8 have the mark scheme for Questions 1 and 2 for the Practical Test.

AS Biology. Planning exercise

Checking Point	Descriptor	The candidate
A	P.1a	Plans a suitable procedure that involves adding different concentrations of calcium chloride to milk and timing how long it takes for the milk to coagulate ;
B	P.1a	Gives a prediction about the effect of calcium ion concentration on, rate of coagulation / coagulation time ;
C	P.1b	Selects suitable apparatus for measuring volumes, observing coagulation and recording time taken to coagulate ;
D	P.3a	States that coagulation of milk involves a named change to a <u>protein</u> ; e.g. hydrolysis, hydrophilic and hydrophobic, soluble to insoluble, precipitation
E	P.3a	Identifies at least 2 key variables to control ; e.g. temperature, volume of milk, type of milk, volume of enzyme solution, volume of sodium citrate, concentration of enzyme, pH
F	P.3b	Decides on an appropriate number of measurements to take, minimum of five different concentrations of calcium chloride (could include 0 mol dm ⁻³) ;
G	P.3b	Decides on an appropriate range of calcium chloride solutions to use (e.g. up to 1.0 mol dm ⁻³) ;
H	P.3b	Describes way of obtaining reliable results, e.g. repeating each concentration twice / carrying out three replicates ;
I	P.5a	Uses appropriate scientific knowledge and understanding in developing a plan e.g. collisions between protein and calcium ions, effects of factors on activity of enzymes - temperature, substrate concentration, enzyme concentration, pH ;
J	P.5a	Uses results or observations from preliminary work or previous practical work to inform the plan ;
K	P.5a	Refers to a safety aspect – gives hazard and precaution ; e.g. calcium chloride / sodium citrate, is an irritant and appropriate precaution (goggles / gloves / lab coat) <i>or</i> rennin / Fromase and allergy and gloves
L*	P.5b	<i>Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC) ;</i>
M	P.5b	Describes how to find the time taken for coagulation ;
N	P.7a	Uses information from two identified sources, e.g. text book, web site, article, class notes, etc. ;
O*	P.7a	<i>Uses spelling, punctuation and grammar accurately ;</i>
P	P.7b	Shows how results are to be presented in a table with all relevant units ;
Q	P.7b	Shows how rate is calculated as 1/t ;
R	P.7b	Shows how results are to be interpreted by drawing a graph of <u>rate</u> against <u>concentration</u> of calcium (chloride) ;
S	P.7b	Comments on, precision / reliability, of results ; e.g. difficulty in identifying end point / identifying and discarding anomalies / repeat to get concordant results

T	P.7b	Comments on calcium (ions) ; e.g. interpret results to take into account presence of calcium ions in milk / discusses use of sodium citrate to remove calcium ions / calculates concentration of calcium ions in milk and concentrations tested / effect of excess sodium citrate on added calcium ions / calcium ions in tap water / calcium ions not in distilled water
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Point mark up to **14** by placing letters **A** to **T** **excluding L and O** in the margin at appropriate points.

Then award **1** mark for each of **L** and **O** (QWC).

Total: 16

Further elaboration of checking points

Checking Point	
A	Don't forget to award this! Usual place is after the final method, but could be the prelim method if appropriate and not modified/repeated as a final method. Concentrations have to be given. R if slides dipped into, test-tubes / boiling tubes
B	Could be given for a sketch graph. Axes must be labelled. Units and values on the axes are not expected for this checking point. A 'more calcium (ions)
C	Volumes - e.g. pipettes / syringes / burette(s) , monitoring – beaker and slide / test-tube, pipette and slide , time – stopwatch
D	This is only for a statement, not a discussion. The term hydrolysis is not important, breakage of peptide bonds / proteolysis will be fine. R liquid → solid / curds
E	The variables only have to be identified. Look for checking point I in any elaboration/discussion of the effect of a variable on enzyme activity. R unqualified 'amounts'
F	Usually given for a table of dilutions, or in the method. The usual concentrations will be 0, 0.1, 0.2, 0.3 1.0 mol dm ⁻³
G	As for F. Look for any that use low concentrations such as 0.001 mol dm ⁻³ – this is fine. It's fine if they treat 1.0 mol dm ⁻³ as 100%
H	Look carefully for this – usually in the method. <i>Repeat twice</i> is correct
I	This may be awarded with the variables or for a discussion of the coagulation process. Look for AS level material. A <i>description</i> of how calcium ions act as a cofactor / activator.
J	There must be some indication that they have done something and then what they have done about it. 'It was too slow so I decided to use a water bath at 37 °C' is an example of the minimum acceptable answer.
K	Always look for a hazard and a precaution. CLEAPSS or equivalent as a reference can contribute to N . R what to do in an emergency.
L*	Lengthy, rambling, incoherent, illogical plans that you have to read two or three times don't get this one. 'Amount' used for volume may be a reason for not awarding this if no units used.
M	They are told that they can use a slide dipped into the milk. Can gain this by dipping slide into milk every 30 seconds and looking for coagulation <i>or</i> dip in and observe the milk on the slide until it coagulates <i>or</i> use a pipette to put a drop on a slide and observe.
N	The references must be cited in the plan. Look carefully for superscripts or other ways of referring to a bibliography. The references must be useful in some way – e.g. help with theory, help with safety, help with method – for example see http://www.ncbe.reading.ac.uk/ncbe/protocols/PRACBIOTECH/PDF/rennet.pdf
O*	Use your professional judgement here. Use the standardisation scripts as a guide. Ignore a few minor slips or one or two consistent errors.
P	Table must have concentration with mol dm ⁻³ / %. Look carefully at column headings and make sure units are used for all. Repeats and average must have time units. Rate does not have to be in the table, but if it is rate as 1/t is fine. Do not expect s ⁻¹ for rate. R if units are in the body of the table.
Q	Accept 1/t, 1000/t or 1/t x 100, etc
R	If a graph is described then dependent variable comes first: '....draw a graph of rate of coagulation against concentration of calcium chloride' Obviously accept refs to x/horizontal and y/vertical. Units are not necessary. R if vertical axis is time as question says <i>rate</i>
S	This is only for results taking not errors in using apparatus, e.g. syringes
T	Calcium ion concentration in milk is about 1.2 g dm ⁻³ . Concentrations of calcium added in method could be adjusted to take into account the calcium concentration

Question		Expected Answers	Marks
1	(a)	<p>1 table format with, column / row headings - lipase concentration, time taken for, <u>rate</u> ;</p> <p>2 <i>treat colour column as neutral</i> R split table</p> <p>3 lipase concentration in, left hand column / first row ; <i>ignore, test-tube letters</i></p> <p>4 / <i>volumes</i></p> <p>5 units in column <i>or</i> row headings - % , seconds / minutes ; <i>ecf if no concentration</i></p> <p>6 time recorded in seconds ;</p> <p>7 correct trend – as concentration increases, time decreases / rate increases ; <i>allow one anomaly</i></p> <p>result for tube A recorded as <u>no change and zero</u> (rate) ;</p> <p>rates calculated correctly and expressed consistently (whole numbers or same number of decimal places) ;</p>	7
	(b)	<p><i>put ticks and crosses on right hand side of script</i></p> <p><i>if time is plotted rather than rate allow ecf, but R MP3</i></p>	
		<p>1 axes correct with lipase concentration on the horizontal axis ;</p> <p>2 axes scaled appropriately using more than half the graph paper ; R if minutes used and not scaled correctly, R broken axis</p> <p>3 axes titles - <u>rate</u> and concentration, % ; R if time</p> <p>4 points plotted accurately ;</p> <p>5 if rate plotted line starts at the origin ; R if broken axis A not at origin if time</p> <p>6 plotted appropriate line of best fit ; R if extends beyond highest concentration / sketchy line</p>	6
	(c)	<p><i>mark (c) and (d) to max 11</i></p>	
		<p>1 increase in, rate / activity, with increase in concentration of lipase ; A rate is proportional to enzyme concentration R correlation unqualified</p> <p>2 comparative data quote ; % <i>and</i> rate/time at two different concentrations</p> <p>3 ref to shape, e.g. straight line / exponential / plateau ;</p> <p>4 ref to anomalous result(s) ; A 'no anomalous results'</p>	
		<p>5 lipid / triglyceride / fat, is <u>substrate</u> ;</p> <p>6 more collisions between, lipase / enzyme, and substrate ; <i>ora</i></p> <p>7 ref to active sites ;</p> <p>8 ref to enzyme-substrate complexes ;</p> <p>9 enzyme concentration is limiting factor / saturation of active sites ;</p> <p><i>if graph has a plateau</i></p> <p>10 substrate concentration is limiting at high(est) concentrations of lipase ;</p> <p>11 AVP ;</p>	
	(d)	<p>12 decrease in pH / increase in acidity / decrease in alkalinity ;</p> <p>13 increase in, concentration of hydrogen <u>ions</u> / $[H^+]$;</p> <p>14 pH decreases below 8.0 to 10.0 or any pH in between ;</p> <p>15 hydrolysis / breakage, of <u>ester</u> bonds ;</p> <p>16 <i>release of fatty acids</i> (and glycerol) ; R if not linked</p> <p>17 dissociation / ionisation, of fatty acids ;</p> <p>18 AVP ; e.g. (fatty acids) neutralise sodium carbonate</p>	11 max

	(e)	<p>1 <i>idea that end point difficult to judge ;</i></p> <p>2 <i>so that end point may not have been the same in each case ;</i></p> <p>3 <i>use colour standard ; R colorimeter</i></p> <p>4 <i>stated problem with timing ; note that stopwatch should be started before mixing</i> <i>e.g. times all overestimates as started stop watch before adding lipase</i></p> <p>5 <i>rates therefore underestimates ;</i></p> <p>6 <i>ref to improved timing method ; R have someone else to start the stopwatch</i> <i>accept way to slow down the reaction e.g. lower temperature / more milk</i></p> <p><i>only one set of results / no repeats ; A 'do repeats'</i></p> <p>7 <i>repeat, twice / more than twice ;</i></p> <p>8 <i>calculate, means / standard deviations ; must be linked to MP 7/8</i></p> <p>9</p> <p><i>only 6 / AW, lipase concentrations ;</i></p> <p>10 <i>wider range / use greater than 5% ;</i></p> <p>11 <i>more intermediates / AW ;</i></p> <p>12</p> <p><i>ref to anomalous results ;</i></p> <p>13</p> <p><i>stated problem with syringe(s) ; A air bubbles / accuracy explained R liquid</i></p> <p>14 <i>in nozzle</i></p> <p>15 <i>use, graduated pipette(s) / burette / micropipette ;</i></p> <p><i>cross contamination from bung ;</i></p> <p>16 <i>use separate bungs / clean the bung / AW ;</i></p> <p>17</p> <p><i>lipase / tubes 1-6, not in water bath ;</i></p> <p>18 <i>lipase / tubes 1-6, in water bath to, equilibrate / acclimatise / AW ;</i></p> <p>19 <i>test-tube of milk removed from water bath before adding lipase ; ora</i></p> <p>20</p> <p><i>problem with maintaining constant temperature ;</i></p> <p>21 <i>rate of reaction / activity, depends on temperature ;</i></p> <p>22 <i>use thermostatically-controlled water bath ;</i></p> <p>23</p> <p><i>ref to drops of phenolphthalein being inaccurate / AW ;</i></p> <p>24 <i>use set volume of phenolphthalein ;</i></p> <p>25 <i>colour changes over a range of pH ;</i></p> <p>26 <i>use, pH meter / pH probe and data logger / more sensitive indicator ;</i></p> <p>27 <i>record time to reach constant pH ;</i></p> <p>28</p> <p><i>AVP ; e.g. percentage error of volume or timing / lipase left in test-tube / not</i></p> <p>29 <i>mixed throughout</i></p> <p><i>AVP ; e.g. improvement linked to disadvantage – invert at intervals</i></p> <p>30</p>	10 max
			[Total: 30]

Question	Expected Answers	Marks
2 (a)	<i>award two marks if correct answer (in range 0.2 to 0.3) is given if answer incorrect or not given, award one mark for dividing any measurement by 20 000</i>	
	$\frac{0.4 \text{ to } 0.6 \text{ cm}}{20\,000} / \frac{4 \text{ to } 6 \text{ mm}}{20\,000} / \frac{4000 \text{ to } 6000 \mu\text{m}}{20\,000}$ 0.2 to 0.3 (μm) ;;	2
(b)	chloroplast(s) ; A thylakoids / grana R stroma / chlorophyll	1
(c)	<p>1 (allow) gases to reach cells / movement of gases ; A gas exchange</p> <p>2 gives large surface area (in contact with air) ;</p> <p>3 ref to diffusion ;</p> <p>4 ref to, oxygen / carbon dioxide ;</p> <p>5 ref to, respiration / photosynthesis ; <i>must be linked with, named gases</i></p> <p>6 ref to water <u>vapour</u> , transpiration ; A evaporation of water</p> <p>7 AVP ; e.g. diffusion is faster in air than in, cytoplasm / water / cells / AW</p>	4 max
(d)	<i>put ticks and crosses on right hand side of script</i> clear, continuous lines ; R shading e.g. for distribution of lignin correct outline - U or V shape with ridges on outer surface ; circles labelled, lignin / stained / xylem / vascular bundle ; circles near, ridged edge / outer edge ;	4
(e)	<i>use annotated drawing to help award marks</i>	
	<p>1 long (vessels) ; R continuous</p> <p>2 comment on width ; A narrow / wide R thick / thin</p> <p>3 parallel ;</p> <p>4 thickening of <u>walls</u> ;</p> <p>5 annular / rings / bands ; R 'annual'</p> <p>6 spiral / helical / coiled ;</p> <p>7 reticulate / net-like / AW ;</p> <p>8 ref to damaged xylem vessels ;</p> <p>9 comment on colour of xylem ; R dark / light / pale</p>	4 max
(f)	<i>ignore 'supports xylem / plant'</i> strengthens (wall) ; R rigid prevents wall, imploding / collapsing / AW ; water in xylem is under tension (by transpiration pull) ; waterproof ; A described AVP ;	3 max
		[Total: max 14]

2804 Central concepts

Question		Expected Answers	Marks																
1	(a)	P = matrix ; Q = inner membrane / crista ; A stalked particles/ AW R = outer membrane ;	3																
	(b) (i)	short, diffusion path / distance to centre ; rapid / AW, diffusion / exchange of materials ; A max surface area:volume ratio idea	1 max																
	(ii)	large / increased, surface area ; for, oxidative phosphorylation / ATP synthase complexes / ATP production / electron carriers / more protons pumped across membrane ;	2																
	(c)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"><i>entering:</i></td> <td style="width: 50%; vertical-align: top;"><i>leaving:</i></td> </tr> <tr> <td>oxygen ;</td> <td>carbon dioxide ;</td> </tr> <tr> <td>pyruvate ;</td> <td>NAD ;</td> </tr> <tr> <td>reduced NAD ;</td> <td>ATP ;</td> </tr> <tr> <td>ADP ;</td> <td>water ;</td> </tr> <tr> <td>phosphate / Pi ;</td> <td></td> </tr> <tr> <td>fatty acid ;</td> <td></td> </tr> <tr> <td>amino acid ;</td> <td></td> </tr> </table> <i>mark first three answers in each column</i>	<i>entering:</i>	<i>leaving:</i>	oxygen ;	carbon dioxide ;	pyruvate ;	NAD ;	reduced NAD ;	ATP ;	ADP ;	water ;	phosphate / Pi ;		fatty acid ;		amino acid ;		6 max
<i>entering:</i>	<i>leaving:</i>																		
oxygen ;	carbon dioxide ;																		
pyruvate ;	NAD ;																		
reduced NAD ;	ATP ;																		
ADP ;	water ;																		
phosphate / Pi ;																			
fatty acid ;																			
amino acid ;																			
	(d)	more, C-H bonds / hydrogen (per molecule) ; A more, hydrogen ions / protons (more) reduced hydrogen carriers / NAD / FAD ; (more) turns of Krebs cycle ; steeper proton gradient ; (more) <u>oxidative phosphorylation</u> ;	2 max																
	(e) (i)	<u>102</u> 145 ; 0.7/ 0.70 / 0.703 ;; <i>award two marks for correct answer with no working</i>	2																
	(ii)	respire aerobically ; mixture (of substrates) ; fat, protein and carbohydrate ; <i>need two for mark</i> correct ref to two RQ values (lipid 0.7,protein 0.9, carbohydrate 1.0) ; different tissues respire different substrates ; <i>treat anaerobic as neutral</i>	2 max																
			[Total: 18]																

Question			Expected Answers	Marks
2	(a)	(i)	T ; R ; V ; W ; S ; <i>only mark if one letter in each box</i>	5
		(ii)	E –centromere ; F-chromatid / locus ; G-chromosome ;	3
		(iii)	centrioles absent ; aster absent ; involved in spore formation in plants and gamete formation in animals ; no, telophase 1 / nuclear membrane formation in telophase 1 ;	1 max
		(iv)	3 ;	1
	(b)	1	crossing over ;	7 max
		2	(between), chromatids / homologous chromosomes ; A within bivalent	
		3	prophase 1 ; (linked to crossing over / description of crossing over)	
		4	ref to chiasma(ta) ;	
		5	(results in) new combinations of alleles ; A recombinants	
		6	chromosome mutation ;	
		7	independent / random, assortment ;	
		8	bivalents / chromosomes ; (linked to 7)	
		9	metaphase 1 ; (linked to 7)	
		10	(independent assortment) of chromatids ;	
		11	metaphase 2 ; (linked to 10)	
			<i>6 max from points 1 to 11 and 15</i>	
		12	gametes genetically different / AW ;	
		13	random fusion of gametes ;	
		14	random mating (within population) ;	
		15	AVP ; e.g. linked genes separated during crossing over, named chromosome mutation	
			<i>annotated diagrams are acceptable</i>	
			QWC – clear well organised using specialist terms	1
			<i>Need to use four of the following: crossing over, chiasma(ta), allele, mutation, bivalent, independent / random assortment, gametes.</i>	
				[Total: 18]

Question			Expected Answers	Marks
3	(a)	(i)	ATP ; reduced NADP / NADPH / NADPH ₂ ;	2
		(ii)	D ; G ; <i>either order</i>	2
		(iii)	respired / used in glycolysis ; A ATP production, energy source (converted to) polysaccharide / named polysaccharide ; A storage carbohydrate (converted to) disaccharide / named disaccharide ; (converted to) pentose / named pentose sugar ; (converted to) lipid ; A fatty acid, glycerol (converted to) amino acids / protein ; (converted to) nucleic acids ; <i>Accept two named polysacchrides, disaccharides or pentose sugars for 2 marks.</i>	2 max
		(iv)	<u>Stroma</u> ; R <u>stoma</u>	1
		(v)	ribulose bisphosphate increases and glycerate 3- phosphate falls ; (less) carbon dioxide combining with, ribulose bisphosphate / Rubisco ;	2
	(b)		light <u>intensity</u> ; wavelength of light ; A colour of light carbon dioxide (concentration) ; temperature ; water ; mineral ions / named mineral ion ; R nutrients	3 max
	(c)	1	increased temperature ; (must be linked to explanation)	
		2	rate of transpiration increases ; A description of transpiration	
		3	increased rate of evaporation from soil ; A reduced, water availability / supply	
		4	ref to ABA / stress hormone ;	
		5	stomatal closure ;	
		6	rate of enzyme controlled reactions increases ;	
		7	rate of respiration increasing ;	
		8	more carbon dioxide produced in leaf ;	
		9	used in photosynthesis ; <i>mp 9 must be linked to mp 8</i>	
		10	A refs to C4 metabolism, carbon dioxide released in leaf –for two marks photosynthetic enzymes not working at optimum ; <i>ignore denature</i>	
		11	increased light intensity ; (<i>must be linked to mp12 or mp13</i>)	
		12	damage to chlorophyll / chloroplasts ;	
		13	movement of chloroplasts ;	
		14	lower rate of photosynthesis ; (<i>must be linked to mp12 or 13</i>)	4 max
				[Total: 16]

Question	Expected Answers	Marks
4 (a)	<p>D1 increasing pressure, increases / less negative / PD ; (at electrode 1/2/electrodes)</p> <p>D2 light or medium pressure, smaller change in PD / at electrode 2 ;</p> <p>D3 ref to generator / receptor potential ;</p> <p>D4 ref to action potential in,axon / neurone / electrode 2, at heavy pressure ;</p> <p>D5 peaks in PD at electrode 2 follows electrode1 ;</p> <p>D6 peaks are delayed as pressure increases ;</p> <p>D7 data quote for D1 (within range -50mV to -30 mV) / data quote for D2(within range -55mV to -45mV) ;</p> <p>D8 data quote for threshold value (-40mV to -30 mV) or action potential (+45mV to +55 mV) ;</p> <p>D9 ref to, hyperpolarisation / -65mV to -70 mV in electrode 2 with heavy pressure ;</p> <p><i>max 4 for description. Only penalise lack of units once.</i></p> <p>E10 pressure / stimulus, causes deformation / AW (of Pacinian corpuscle) ;</p> <p>E11 increased permeability to sodium ions / sodium channels open ;</p> <p>E12 sodium (ions) move in (corpuscle / receptor / axon) ;</p> <p>E13 causes depolarisation / AW (i.e. from -ve to +ve) ;</p> <p>E14 increasing pressure more sodium (ion voltage gated) channels open ;</p> <p>E15 ref to threshold value / AW ;</p> <p>E16 sodium (ions) move along, axon / sensory neurone; A. ref to local circuit ;</p> <p>E17 ref to repolarisation ;</p> <p>E18 AVP ; e.g. ref to role of potassium (ion gated) channels / ref to sodium – potassium pump/ ref to all or none principle.</p>	8 max
	QWC – legible text with accurate spelling, punctuation and grammar;	1
(b)	<p>1 no uptake of calcium (ions) ;</p> <p>2 into, <u>presynaptic</u> membrane / synaptic bulb ;</p> <p>3 no, movement / fusion of synaptic vesicles, to / with <u>presynaptic membrane</u> ;</p> <p>4 no, exocytosis / release of, neurotransmitter / named neurotransmitter ;</p> <p>5 no diffusion / movement (of neurotransmitter) across synaptic cleft ;</p> <p>6 no binding to receptor on <u>postsynaptic membrane / sarcolemma</u> ;</p> <p>7 no depolarisation of, postsynaptic membrane / sarcolemma ; A ref to Na ions / channels</p> <p>8 no, action potential / impulses / depolarisation of t-tubule ;</p> <p>9 brain does not detect pain (in humans) ;</p> <p>10 no muscle contraction (in fish) ;</p> <p><i>ora throughout for candidates who state what normally happens and then says this will not happen with the drug. Max 4 if do not mention that events will not happen.</i></p>	5 max
		[Total: 14]

Question		Expected Answers	Marks
5	(a)	(i) $\frac{0.6}{11.2} \times 100$ or $\frac{0.8}{9.4} \times 100$; or $100 - (10.6/11.2 \times 100)$ or $100 - (8.6./9.4 \times 100)$; <i>beak length: 5.4% (A 5.36%) ;</i> <i>beak depth: 8.5% (A 8.51%) ;</i> <i>If no working shown 2 marks for one correct answer 3 marks for two correct answers.</i>	3
		(ii) food / seed, shortage / AW ; A competition for food competition from large ground finch / <u>interspecific</u> competition ; R competition unqualified	2
		(iii) no, competition from large ground finch / <u>interspecific</u> competition ; A no large ground finches present. seed size larger ; A size / hardness, of seeds has changed	1 max
	(iv)	1 variation (in beak size) ; 2 those with large beaks in competition with large ground finch ; A struggle for survival idea 3 medium ground finch out competed ; 4 smaller size beaks for opening small seeds ; 5 less (interspecific) competition for small seeds ; 6 birds with small beaks more likely to survive ; 7 reproduce / AW ; 8 pass on, small beak / favourable, <u>alleles</u> ; A ora 9 over a number of generations ; 10 increase in frequency, small beak / favourable alleles ; A ora	5 max
	(b)	<i>disagree (no mark on own)</i> change in phenotypic feature is taking place ; A beaks have changed directional selection taking place ;	1 max
			[Total: 12]

Question			Expected Answers	Marks
6	(a)	(i)	<u>predator : prey ;</u>	1
		(ii)	<p>D1 1970 – moose population 1000 ; D2 1970 - wolf population 15 ; D3 moose population increases until 1975 / peaks at 1500 ; D4 wolf population increases until 1980 / peaks at 40 ; D5 wolf peak / fall, after moose peak / fall ; D6 moose population declines to 850 ; D7 coincides with peak in wolf population (in 1980) ; <i>linked to D6</i> D8 1985 - moose population 1000 and wolf population 24 ;</p> <p><i>3 max for description</i></p> <p>E9 moose population increases due to less wolf predation / ora ; E10 shortage of food (moose) causes fall in wolf population / ora ; E11 ref. to intraspecific competition ; E12 ref. to other factors causing population change ; E13 length of reproductive cycle idea to explain lag in population peaks ;</p>	4 max
		(b)	<p>reduction in fertility ; less, variability of genome / heterozygosity / reduced gene pool, ora ; more chance of harmful recessive alleles being expressed ; greater incidence of genetic diseases ; less able to cope with environmental change/ AW ;</p>	2 max
		(c) (i)	<p>less food / vegetation available ; fat reserves depleted ;</p> <p>fat reserves act as insulation ; difficult to lose heat / could over-heat ; less food eaten / lack of appetite ; only those with thin fat reserves survive overheating ;</p> <p>cooler summers stimulate fat deposition ;</p>	2 max
		(ii)	<p>moose weakened by parasites / poorly insulated ; unable to cope with winter conditions / AW ; easy prey for wolves / more food for wolf population ; less <u>intraspecific</u> competition ; successful reproduction more of young survive ;</p>	3 max
				[Total: 12]

2805/01 Growth, Development and Reproduction

Question			Expected Answers	Marks						
1	(a)	(i)	<table border="1"> <tr> <td></td> <td>ovary / corpus luteum / placenta :</td> </tr> <tr> <td></td> <td>testis / interstitial cells / cells of Leydig ;</td> </tr> <tr> <td></td> <td>hypothalamus ;</td> </tr> </table>		ovary / corpus luteum / placenta :		testis / interstitial cells / cells of Leydig ;		hypothalamus ;	3 max
			ovary / corpus luteum / placenta :							
			testis / interstitial cells / cells of Leydig ;							
	hypothalamus ;									
	(ii)	<p><i>Accept answers from a relevant example</i></p> <p>change (in parameter), detected / monitored / AW ; mechanism / hormone / effector , causes change (in parameter) / AW ; parameter returned to normal / set point ;</p>	2 max							
	(b)	<p>suckling stimulates, nerve endings / receptors / nervous reflex ; positive feedback (involved in suckling) ; impulse to hypothalamus ; hypothalamus, produces oxytocin ; travels along, nerve cells / neurones / axons / ref to neurosecretion ; released / secreted, from <u>posterior</u> pituitary gland ; travels in blood ;</p> <p>causes 'let-down' / ejection of milk ; in presence of prolactin ;</p> <p style="text-align: right;">3 max</p> <p>(oxytocin causes / stimulates uterine) muscle / myometrium, to contract ;</p>	4 max							
	(c)	(i)	<p>respiratory substrate / AW ; R energy for growth for insulation ; protection around organs ; cell membranes / phospholipid ; production of hormones / named hormone ; myelin sheath ; cholesterol / glycolipid, production ;</p>	2 max						
		(ii)	<p>cannot be synthesised / made ; from non – essential fatty acids ; necessary enzymes lacking ; ref. to deficiency disease e.g. dermatitis, growth retardation ; AVP ; e.g. linoleic / linolenic / arachidonic breast tissue selects EFA's from maternal blood used to make prostaglandins</p>	2 max						

		(iii) exact nutritional requirements / AW ; provides antibodies / immunity / colostrum ; sterile / infection less likely ; allergies less likely ; AVP ; e.g. close emotional bonding	1 max
			[Total: 14]

Question		Expected Answers	Marks
3	(a)	<p>1 grow / use, large number of seeds / plants ;</p> <p>2 take sample / at least 10 ;</p> <p>3 remove all growth medium from roots / AW ;</p> <p>4 dry / heat, in oven / incubator ;</p> <p>5 repeat until no change in mass / weight ;</p> <p>6 ensure conditions identical / example of condition kept the same ;</p> <p>7 take measurements at, regular / stated, intervals ;</p> <p>8 repeat and calculate mean ;</p> <p>9 AVP ; e.g. sow in nitrogen neutral medium(AW) / vermiculite / perlite / hydroponics details of suitable method of applying different concs of nitrate</p> <p style="text-align: right;">max 4</p> <p>10 <u>absolute / actual, growth</u> curve) ;</p> <p>11 plot dry mass (y axis) against time (x axis) ;</p> <p>12 <u>absolute growth rate</u> curve, is change in mass / gain in mass in set period, against time ; AW</p> <p>13 <u>relative growth rate</u> curve , plus correct method of calculation ;</p>	7 max
		QWC – legible text with accurate spelling, punctuation and grammar ;	1
	(b)	<p>X testa ;</p> <p>Y cotyledon ;</p>	2
	(c)	<p>does not kill / destroy plant ;</p> <p>fewer seeds needed ;</p> <p>follow growth of same plant ;</p> <p>AVP ;</p>	1 max
	(d)	(i) $\frac{62 - 19}{2} ;$ <p>Answer = 21.5 ;;</p>	<p><i>correct figures +/- 1 = 1 max</i></p> <p><i>not to one decimal place 1 max</i></p> <p style="text-align: right;">2</p>

		<p>(ii)</p> <p>1 gibberellin concentration increases, then decreases / AW ;</p> <p>2 length of hypocotyls increases slowly, then rapidly, then plateaus / AW ;</p> <p>3 correct ref to figs to illustrate trends using both axes (four figs) ;</p> <p><i>Explanation</i></p> <p>4 plant growth regulator ;</p> <p>5 increases length of the hypocotyls ;</p> <p>6 promotes cell elongation ;</p> <p>7 hypocotyls stops growing because, gibberellin conc falls / ora ;</p> <p>8 stimulates enzyme / amylase production ;</p> <p>9 involved in gene switching ;</p> <p>10 in aleurone layer ;</p> <p>11 length of hypocotyls reaches max as, cotyledons become green / photosynthesis begins ;</p> <p>12 ref to delay in growth response to gibberellin :</p> <p>13 AVP ; e.g. uptake of water stimulates gibberellin production breaks dormancy / begins germination reasonable explanation for fall in conc of gibberellin</p>	<p>max 4 5 max</p>
			<p>[Total: 18]</p>

Question		Expected Answers	Marks
4	(a)	<p><i>Mark (i) and (ii) as a whole</i></p> <p>(i)</p> <p>1 length of dark period is important ; AW</p> <p>2 (critical period) any figure between 6 and 10 hours ;</p> <p>3 at night / in dark, Pfr / P730 is converted to Pr / P660 ;</p> <p>4 (as above) slowly ;</p> <p>5 in daylight, Pr is converted to Pfr ;</p> <p>6 Pfr is biologically active form ;</p> <p>7 Pfr inhibits flowering (in SDP's) ;</p> <p>8 in C, in dark enough Pfr is converted to Pr (so flowers) ; AW</p> <p>9 in D, in dark not enough Pfr converted back (flowering is inhibited) ; AW</p>	4 max
		<p>(ii)</p> <p>10 <u>red</u> light converts Pr to Pfr ;</p> <p>11 in E (the conversion, Pr to Pfr), happens quickly / in large amounts/ not enough darkness follows (to allow flowering) / AW ;</p> <p>12 (In F) after the flash of <u>red</u> light, the <u>far red</u> light converts Pfr to Pr ;</p> <p>13 last exposure is effective / FR reverses effect of R (on flowering) ;</p>	4 max
	(b)	<p>(i)</p> <p>codon / triplet / base sequence, (on mRNA) determines, primary structure / sequence of amino acids ;</p> <p>mRNA leaves nucleus ;</p> <p>attaches to ribosome ;</p> <p>tRNA attached to amino acid ;</p> <p><u>anticodon</u> on tRNA ;</p> <p><u>codon</u> on mRNA ;</p> <p><u>complimentary</u> bases join / bind / link ;</p> <p>peptide bonds formed between (adjacent) amino acids ;</p> <p>translation ;</p>	4 max
		<p>(ii)</p> <p>not enough constans formed ;</p> <p>(is a long day plant so) needs Pfr in order to flower ;</p> <p>after a long night, all Pfr has been converted (so does not flower) ;</p> <p>AVP ; e.g. ref. to link between Pfr and constans</p>	2 max
			[Total: 14]

Question		Expected Answers	Marks
5	(a)	<p>mark one method only. If two methods given mark both and award highest mark. allow once (in either method)</p> <p>mitosis / <u>genetically</u> identical / clone ; spores / conidia ; at tips of (vertical) hyphae ; <u>conidiophores</u> / <u>sporangiophores</u> ; light / small / numerous, for dispersal ;</p> <p>Or</p> <p>budding ; occurs in yeast ; grow attached to / on side of, parent cell ; break off to form new individual ;</p>	<p>R buds off</p> <p>3 max</p>
	(b)	(i)	<p>anaerobic respiration / respiration in absence of oxygen ; pyruvate to ethanal ; decarboxylation / removal of carbon dioxide ; R CO₂ given off ethanal to ethanol ; 1 mark for pyruvate <i>to ethanol</i></p> <p>ethanal is hydrogen acceptor ; AVP ; e.g. ref. to NADH / NAD(reduced), providing H (ethanal to ethanol)</p> <p>3 max</p>
		(ii)	<p>(ethanol) toxic / poisonous (to yeast) ; R kills disrupts membranes / AW ; denaturation of enzymes ; change in, shape / tertiary structure, of active site ; slower reaction rate ; AVP ; e.g. ref. enzyme inhibition / ref. end – point inhibition</p> <p>2 max</p>

	(c)	<p><i>mitosis</i></p> <p>1 produces, <u>genetically</u> identical / no <u>genetic</u> variation / clones ; 2 (tubers produce plants) already adapted to the environment ; 3 many, tubers / cells / AW, produced / rapidly colonise an area ; 4 no need for second plant / pollinators ; 5 no waste of, gametes / energy producing gametes etc ; 6 tuber is, food store/ means of overwintering ;</p> <p>7 produces, pollen mother cells, by mitosis ; 8 pollen <u>nucleus</u> divides into generative / pollen tube nucleus, by mitosis ; 9 generative nucleus divides into two male gametes, by mitosis ; 10 embryo sac nucleus divides, three times / to form eight nuclei ;</p> <p style="text-align: right;">4 max</p> <p><i>meiosis</i></p> <p>11 halves chromosome number / diploid to haploid / produces haploid gametes ; 12 diploid number restored at fertilisation ; 13 increases, <u>genetic</u> variation ; 14 ref. independent assortment ; 15 ref. crossing over / linkage / AW ; 16 adapt to changing environment / ref to natural selection / evolution ;</p> <p>17 <u>embryo sac mother cell</u> divides by meiosis (to four haploid cells) ; 18 <u>pollen mother cell</u> divides by meiosis (to form tetrad) ;</p> <p>19 AVP ; e.g. diploid zygote divides (by mitosis) to form embryo</p> <p style="text-align: right;">4 max</p>	7 max										
		QWC – clear well organised using specialist terms ;	1										
		<p><i>Award QWC if three of following used in correct context and sequence:</i></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"><i>gamete</i></td> <td style="width: 50%; vertical-align: top;"><i>pollen mother cells</i></td> </tr> <tr> <td style="vertical-align: top;"><i>generative nucleus</i></td> <td style="vertical-align: top;"><i>pollen tube nucleus</i></td> </tr> <tr> <td style="vertical-align: top;"><i>embryo sac</i></td> <td style="vertical-align: top;"><i>polar nuclei</i></td> </tr> <tr> <td style="vertical-align: top;"><i>independent assortment</i></td> <td style="vertical-align: top;"><i>crossing over / linkage</i></td> </tr> <tr> <td style="vertical-align: top;"><i>zygote</i></td> <td style="vertical-align: top;"><i>diploid / haploid</i></td> </tr> </table>	<i>gamete</i>	<i>pollen mother cells</i>	<i>generative nucleus</i>	<i>pollen tube nucleus</i>	<i>embryo sac</i>	<i>polar nuclei</i>	<i>independent assortment</i>	<i>crossing over / linkage</i>	<i>zygote</i>	<i>diploid / haploid</i>	
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<i>zygote</i>	<i>diploid / haploid</i>												
			[Total: 16]										

Question		Expected Answers	Marks
6	(a)	follicles ; thyroglobulin ; endocytosis ; hydrolysis ;	4
	(b)	(i) thyrotrophin / thyrotrophic releasing hormone / factor / TRH / TRF ; R thyroxine <u>anterior</u> pituitary (gland) ; <u>thyroid stimulating hormone</u> / TSH ;	3
		(ii) decrease in temperature ; higher centres of the brain ; negative feedback / fall in thyroxine ; AVP ;	2 max
		(iii) switches on / increases, <u>transcription (of mRNA)</u> ; A causes / helps more increases, protein / enzyme synthesis ; R allows / involved in increases, respiration ; stimulates growth / AW ; development of the skeletal system ; stimulates, brain development ; AVP ; e.g. hormone binds to receptor protein on the nucleus Inhibits secretion of TRH	2 max
			[Total: 11]

2805/02 Applications of Genetics

Question			Expected Answers	Marks
1	(a)	(i)	green-based is dominant (to uniform colour) / G is dominant to g / ora <u>re</u> recessive ;	1
		(ii)	red (fruit) is dominant to orange (fruit) / R is dominant to r / ora <u>re</u> recessive ;	1
	(b)		ggrr / rrrg ;	1
	(c)		<p><i>parental phenotypes</i> green-based red x uniform orange ;</p> <p><i>parental genotypes</i> GgRr ggrr ;</p> <p><i>gametes</i> GR Gr gR gr gr ;</p> <p><i>offspring genotypes and phenotypes</i></p> <p> GgRr Ggrr ggRr ggrr ;</p> <p> green-based red green-based orange uniform red uniform orange ;</p>	4 max
	(d)	(i)	3 ;	1
		(ii)	> 0.1/ greater than 0.1 ;	1
		(iii)	<p>difference from expectation is not significant/statistically different ;</p> <p>above (critical) value (0.05) / AW ;</p> <p>result due to chance ;</p> <p>prediction correct / null hypothesis should be accepted ;</p> <p>loci (apparently), assort independently / not linked ;</p>	3 max
	(e)		<p>loci (too) far apart (for linkage to be detected) ;</p> <p>ref. recombinants ;</p> <p>crossing over has occurred ;</p> <p>detail crossing over ;</p> <p><i>[in prophase I of meiosis / exchange of (part of) non-sister chromatids]</i> ignore chiasmata</p> <p>has occurred, twice / even number of times ;</p> <p>(therefore) restoring loci to parental combinations ;</p> <p>diagram ;</p>	3 max
				[Total: 15]

Question		Expected Answers	Mark	
2	(a)	(i)	<p><i>cross 1</i> 7, 7 ;</p> <p><i>cross 2</i> 14, 7 ;</p>	2
		(ii)	<p>chromosome number has doubled ;</p> <p>ref. polyploidy ;</p> <p>nuclear division but no cell division ;</p> <p>failure of spindle in mitosis ;</p> <p>non-disjunction ;</p>	2 max
	(b)		<p>different numbers (42 & 14) of chromosomes ;</p> <p>different numbers (21 & 7) of chromosomes in gametes ;</p> <p>chromosomes cannot pair ;</p> <p>ref., synapsis / homologous pairs, in meiosis ;</p> <p>meiosis fails ; [R 'cannot occur']</p> <p>hybrid/new plant sterile ; R not viable</p>	2 max
	(c)	<p>1 act as gene banks ;</p> <p>2 source of genetic diversity ; (a) maintain genetic diversity</p> <p>3 store of <u>alleles</u> ;</p> <p>4 for future use ;</p> <p>5 in selective breeding of wheat ;</p> <p>6 to restore alleles lost in selective breeding/ counter effect of inbreeding/genetic erosion ;</p> <p>7 in case different traits needed/ changed consumer demand ;</p> <p>8 in case climate change ;</p> <p>9 e.g. global warming / temperature rise ;</p> <p>10 e.g. drier conditions ; not environmental change</p> <p>11 in case new, pathogen / disease ;</p> <p>12 in case new pest ;</p> <p>13 may have as yet unrecognized trait ;</p> <p>14 AVP ; e.g. detail / i.e. disease resistance to new disease</p> <p>15 AVP ; e.g. genetic engineering</p>	8 max	
		QWC - legible text with accurate spelling, punctuation and grammar ;		1
			[Total: 15]	

Question		Expected Answers	Marks
3	(a)	outbreeding increases reproductive success ; outbreeding increases mean number of live offspring ORA ; comparative figures ; [<i>two of 39, 48, 64</i>] or NN approx double BB outbreeding decreases percentage of females aborting brood ORA ; comparative figure ; [<i>two of 40, 20, 10</i>] R wrong units	3 max
	(b)	<i>outbreeding</i> increases genetic diversity of offspring ; increases heterozygosity / reduces homozygosity ; reduces expression of deleterious recessive alleles / AW ; reduces / avoids, inbreeding depression ; ref. hybrid vigor / increases viability ;	3 max
	(c)	for expression of desired <u>recessive</u> allele / AW ; to get (desired) homozygosity ; to produce pure-breeding variety ; because so few individuals exist ; AVP ; e.g. production of F ₁ hybrids/mass selection	1 max
	(d)	shows relationships ; identifies parent(s) ; similar bands show genetic similarity / AW ; most diverse chosen to breed / most similar not bred / AW ;	2 max
	(e) (i)	to produce desirable change in phenotype/characteristic(s)/traits ; for benefit of humans ; by <u>artificial</u> selection ; of parents showing desirable traits ; to greater extent than other individuals ;	2 max
	(ii)	selective breeding tends to reduce genetic diversity ; captive breeding needs to maintain (maximum) genetic diversity/stop inbreeding ; selective breeding humans do the choosing/choose parents on grounds of particular phenotype/benefit to humans ; captive breeding parents should not be chosen for particular phenotype/ or random ; weak / unattractive, individuals may have desirable alleles ; AVP ; idea that breeding should be for benefit of individual/population	4 max
			[Total: 15]

Question		Expected Answers	Marks
4	(a)	allows AI ; store of alleles ; sperm from desirable male can be used anywhere (in the world) ; (a) removes cost of transport ; after death of male ; quickly available ; tested for, genetic disease / sex ; reduced risk /stress/cost of keeping male with herd ; allows use of different males ; may reduce inbreeding short-term / AW ;	4 max
	(b)	(i) cooled at $1^{\circ}\text{C min}^{-1}$; thawed, slowly / at $1^{\circ}\text{C min}^{-1}$;	2
		(ii) crystals grow ; A expand <u>break/pierce</u> plasma (cell surface) <u>membrane</u> ; R just damage break, intracellular <u>membranes</u> / membraneous organelles ; e.g. of intracellular membrane / organelle ; ref. to osmotic effects ;	2 max
		(iii) slow thaw allows ice crystals to grow ; when sperm cooled rapidly ; most ice damage rapid cool slow thaw ; ora least damage fast cool, fast thaw no ice crystals present after slow cooling ; so difference caused by other factor(s) ; e.g. volume / water uptake / water potential / osmosis / AW ; ref. figs. ;	3 max
	(c)	does a couple have a right to a child ; should we meddle in fertility/genetic disease ; AI(D) no longer anonymous (UK)/child has right to know who father is ; problem if child (when old enough), seeks / finds, biological father ; apparent father may be rejected ; AI(D) child not offspring of apparent father who may not bond with child/third party into relationship ; idea of unethical selection of donor sperm for particular characteristics ; AVP ; ; e.g. lesbian/gay couples, single women ,religious objections R biological problems- inbreeding, genetic disease of donor, ignore 'playing God' / unnatural	4 max
			[Total: 15]

Question		Expected Answers	Marks
5	(a)	binding site/ receptor (on protein) ; detail of binding site ie on cell membrane ; complementary shapes (AW) / ref. lock and key ; A active site binding results in shape change (which triggers reaction) ;	2 max
	(b)	natural selection ; leaves are selective agents ; respond to product of <i>avrPphB</i> ; random / chance mutation ; <i>avrPphB</i> not expressed/mutation so, no reaction / survive ; mutated <i>avrPphB</i> / mutation/allele passed on to offspring ;	4 max
	(c)	1 <u>gene mutation</u> ; 2 not chromosomal because, prokaryote / not eukaryote / AW ; 3 random / chance ; 4 change in triplet code of DNA ; 5 base / nucleotide, <u>substitution</u> ; penalize base/nucleotide once 6 (base / nucleotide), <u>deletion</u> ; 7 (base / nucleotide), <u>addition</u> ; 8 different amino acid (coded for change in triplet) ; 9 frame shift ; 10 explanation of consequence(for frame shift) ; 11 (changed 1° structure so) different 3° structure / AW ; 12 ineffective product / AW ; 13 (premature) stop triplet ; R codon in DNA 14 product incomplete ; 15 mutation in, regulator / promoter / operator / 'switch' ; 16 RNA polymerase does not bind ; 17 so gene not transcribed ; 18 AVP ; e.g. no longer binds/active site changed / R group changed / different attributes	8 max
		QWC - clear, well-organized using specialist terms ; <i>Must include three terms such as regulator, promoter, operator, triplet code, tertiary, frame shift ,(substitution, deletion, addition, only 2 from this)</i>	1
			[Total: 15]

2805/03 Environmental Biology

Question		Expected Answers	Marks
1	(a)	release of chlorine / bromine / CFC's or HFC's chemicals ; idea that these build up in <u>upper</u> atmosphere / AW ; ref to photochemical reaction releasing free radicals / AW ; free radicals split ozone to oxygen ; detail of reaction e.g. $\text{Cl} \cdot + \text{O}_3 \rightarrow \text{ClO} \cdot + \text{O}_2$ / $\text{ClO} \cdot + \text{O} \rightarrow \text{Cl} \cdot + \text{O}_2$; idea of free radicals recycled ; ref to cold temperatures leading to accumulation of CFC's / AW ;	max 3
	(b)	ban / reduce, use of, chlorine-based / bromine-based, propellants ; use of non-ozone destroying alternatives (a named example e.g. HFC) ; countries signing up to international / named, protocols (to reduce emissions) ; AVP ; e.g. better disposal of fridges / change in aerosol propellant	max 1
	(c) (i)	(visible blue / red light) has insufficient energy to break C-C bonds ; ref to energy data for visible blue / red light ; R if no units AVP ; e.g. repairable damage if occurs	max 2
	(c) (ii)	ozone loss allows uv rays to reach earth's surface / ora ; ref. to uv light has 400 kJ of energy per mole of photon / has energy to break C-C bonds / AW ; DNA has many C-C bonds ; uv light can disrupt DNA leading to mutations ; mutations can lead to, cancer / named cancer ; R cancer if not linked to mutation AVP ; e.g. idea of unrepairable damage / effect on algal metabolism / effect on young amphibians / cataracts	max 4
			[Total: 10]

Question		Expected Answers	Marks
2	(a)	$(8.64 + 8.64) = 17.28$	max 1
	(b)	<i>ecf throughout</i> hypothesis not supported / AW ; ref to 1 df ; chi-squared result compared to table at 0.05P (look at annotated table) ; R probabilities of 0.10 correct ref to probability due to chance is too small ;	max 3
	(c)	larger the area the more species counted ; comparative data quote between 2 points ; max species count with area of 0.65 to 0.7m ² / no increase after 0.65 to 0.7 m ² ; R if no units included most change occurs with smallest quadrats / steep increase at start / AW ;	max 3
	(d) (i)	deflected succession / plagioclimax ;	max 1
	(ii)	burning ; herbicide application ; cutting / mowing ; (visitor) trampling ; AVP ; e.g. allowing access to site to military vehicles / hand-weeding	max 2
	(iii)	disturbance creates new <u>niches</u> / AW ; idea that these (niches) provide opportunity for new species / AW ; idea that there may be more habitats ; idea of (possibility of) more food chains ; leading to increased (complexity) of food web ; reduction in, interspecific competition / competition between species / AW ; grazers may remove dominant species / AW ; greater nutrient / light / space for other species ; AVP ; e.g. possibility of faecal matter alters nutrient status linked to soil fertility / AW AVP ; e.g. grazing prevents climax community being reached so increasing biodiversity / AW all answers could be a possible ora	max 4
			[Total: 14]

Question	Expected Answers	Marks
3 (a)	<p>all three London regions need to reduce the amount of waste sent to landfill / AW ; West London needs to make greatest reduction ; North London can make lowest reduction / can increase amount land filled in 2010 ; comparative data quote ;</p> <p>implication is a need for increase in recycling ; example of how to do this e.g. door to door collections ; and other example of how to do this e.g. cash incentives ; example of increased waste reduction e.g. by less packaging / re-use ; ref to increase incineration / used for energy generation ; AVP ; e.g. charging for carrier bags or non-recyclables or weighing of rubbish AVP ; e.g. composting</p>	max 5
(b)	<p><i>ways that pollutants enter – max 2</i></p> <p>1 direct into water / run off / leaching / leachate e.g. into drains and then rivers / ref to sewage and flooding / AW ; 2 sea dumping ; 3 land burial / land fill without lining / AW ; 4 leaks in lining of land fill ; 5 AVP ; e.g. fly tipping / industrial waste water</p> <p><i>effects – max 6</i></p> <p>6 stay in environment and are slow to degrade / persistent / AW ; 7 enter food chains / AW ; 8 concentration in fatty tissues / AW ; 9 idea of build up / bioaccumulation ; 10 idea of toxicity ; 11 decreases biodiversity ; 12 idea of liquid pollutant with high nitrogenous content e.g. slurry ; 13 idea of eutrophication and these effects ; 14 and 15 idea of effect upon organisms e.g. egg shell thinning, lowered reproduction rates, disruption to immune system, developmental defects, cancers, kidney failure, behavioural problems ; (any two for 2 marks)</p>	max 7
	QWC – clear well organised using 3 specialist terms	1
(c)	<p>sediment removal ; storage / holding tanks ; banning / reduce use of chemicals / international legislation ; banning, contaminated food / shell fish / fish ; fines / incentives to treat ; better treatment / improved drainage / method of treatment e.g. use of reedbeds ; AVP ; e.g. further amplification of treatment</p>	max 3
		[Total: 16]

Question		Expected Answers	Marks
4	(a)	farmers required to adopt traditional approaches to agriculture / AW ; incentives to, adopt / adhere to, govt guidelines / financial cost or benefit to farmer ; reduced use of fertilisers ; increased maintenance of hedgerows ; reduced pesticides ; AVP ; e.g. do not drain the land	max 2
	(b)	nitrates are (highly) soluble ; leads to leaching / AW ; leading to (increased chance) eutrophication ; 2 marks for ref detail of eutrophication ; AVP ; e.g. ref human health problem (s) e.g. blue-baby syndrome	max 3
	(c)	SSSI's are regulated by laws / more rigid legal framework ; ora SSSI's protect small areas ; ora SSSI may be given for 1 or few species - ESA's given for broader protection of ecosystem / AW ; SSSI's need to be actively maintained / AW ; AVP ; e.g. SSSI's have research value	max 2
	(d)	<i>Any two from:</i> CITES ; fox hunting ban (with hounds) ; nitrate vulnerable zone ; heritage coast status ; farm woodland scheme ; set-aside ; Area of Outstanding Natural Beauty / or abbreviations ; National Park ; Local Nature reserves ; R NNR's The Wildlife and Countryside Act (1981) ; tree preservation orders ; Protection of Badger Act (1992) ; fisheries conservation policy ; prevention of collection of birds eggs ; collection of orchids; AVP ;	max 2
	(e)	purchases / manage reserves ; fund-raise / membership funds ; raise public awareness / campaign / education ; provide evidence for prosecution ; lobby parliament ; challenge developments ; carry out research / surveys ; AVP ; e.g. specific detail relating to one such example	max 4

	(f)	<p>1 need to remove wild birds / increasing risk of extinction if fails ;</p> <p>2 failure / lower breeding rate in captivity / AW ;</p> <p>3 inbreeding / inbreeding depression ;</p> <p>4 increase chance of deleterious / harmful alleles ;</p> <p>5 more prone to disease ; R if not linked to points 3 or 4</p> <p>6 reasons for decline may still be there / AW ;</p> <p>7 captive bred animals may not readjust to wild ; e.g. feeding / nesting problems</p> <p>8 AVP ; e.g. stress</p>		
				max 5
			[Total:	18]

Question		Expected Answers	Marks
5	(a)	fluctuation / low catch and then high catch ; comparative paired data quote ; valid comment regarding years when catch drops below S level ; ora	max 2
	(b)	size of population number known / AW ; breeding data / gestation period / time to reach maturity / AW ; emigration / immigration rate ; birth / death / mortality / disease rates ; food source stability / AW ; population structure e.g. age structure / sex ratio ; AVP ; e.g. number of fisherman available for future catches	max 3
	(c)	<ol style="list-style-type: none"> 1 obtain tissues from range of individuals in population / ref to random selection / AW ; 2 prepare (microscope) slides of cells / use microscope ; 3 idea that prepared cells must be dividing / undergoing mitosis ; 4 selected cells at same stage / named stage of mitosis ; 5 measure / study / compare, chromosome <u>length</u> / AW ; 6 detail of measurement e.g. use of eye piece graticule ; 7 replicate to obtain mean for each whale / AW ; 8 calibrate against whales of known age ; 9 AVP ; e.g. marked whales to avoid recapture 	max 4
	(d)	<p><i>max 2 from</i></p> <p>catch fish sample / AW ; suitable markers or tags ; idea of tags not interfering with fish behaviour ; release sample (back into habitat) ; second sample caught after given period of time ;</p> <p><i>Must have for full marks</i></p> <p>calculation of population using correct formula (Lincoln Index) ;</p>	max 3

	(e)	<p><i>Any named resource and area (max 1)</i></p> <p>1 e.g. North sea - cod / haddock ; 2 e.g. Pacific – tuna ; 3 e.g. Cameroon – finish ; 4 e.g. Baltic – sturgeon ;</p> <p><i>conservation action (max 6)</i></p> <p>5 maximum sustainable yield calculated (MSY) ; 6 idea of setting of quotas ; 7 idea of policing ; 8 ref to, mesh / net, sizes ; 9 regulation of fish sizes landed ; 10 fishing bans in specific areas / exclusion zones / marine nature reserves ; 11 ref to bans during breeding times ; 12 boat decommissioning / decrease in fleet size / licenses ; 13 restriction in fishing effort e.g. days at sea ; 14 co-operation between countries to adhere to, laws / policy agreements ; 15 use of aquaculture (to conserve wild stock) ; 16 AVP ; e.g. penalties and fines 17 AVP ; e.g. consumer pressure / marketing new species</p>	max 7
		QWC – legible text with accurate spelling punctuation and grammar	1
			[Total: 20]

Question		Expected Answers	Marks
6	(a)	<p>very toxic ; easily spread throughout stream / leached into water ; sheep dip kills insect / invertebrate pests directly ; invertebrates will have large surface area to volume ratio and so absorb lots of pollution / AW ; persistent over time / long lasting / AW ref to bioaccumulation in food chains / webs ;</p>	max 3
	(b)	<p><i>any three from the following:</i></p> <p>no (pesticide) pollution ; no development of resistance in pests ; fewer treatments / longer lasting / cost ref ; ref to improved health of farmers ; disease eradication ; less pesticide residues in food chains ; organic food status ; ref to (herd) immunity ; AVP ; e.g. link to biodiversity maintenance</p>	max 3
	(c)	<p>meiosis may not be completed ; fewer / no gametes produced ; reduced variation / AW ; gametes could get wrong chromosome number / AW ; gametes could become unviable / cannot fertilise ; potential to cause chromosome abnormalities in offspring ; AVP. ; e.g. example of named chromosome abnormality</p>	max 3
	(d)	<p>susceptible individuals die ; presence of resistant, individuals / ref to selective advantage ; survival of fittest ; surviving individuals pass on advantageous / resistant <u>alleles</u> for resistance ; increase in allele frequency ; AVP ; e.g. overproduction, directional selection</p>	max 3
			[Total: 12]

2805/04 Microbiology and Biotechnology

Question		Expected Answers	Marks
1	(a)	(cheap cuts of meat) tough / chewy / fibrous / AW ; R not tender bromelain / enzyme, (in pineapple) enters / penetrates, meat ; AW hydrolytic / hydrolase / proteolytic / protease / digestive; (breakdown of) fibrous proteins / collagen / elastin ; A connective tissue left for time to allow, enzyme action / digestion / hydrolysis / breakdown, to occur ; cooking, stops enzyme action / denatures enzyme ; AVP ; e.g. pineapple adds flavour polypeptides / proteins, to peptides / amino acids release of, amino acids / peptides, adds flavour breakdown of peptide bonds ref. to texture obtained if left for different lengths of time (too long, too soft) makes cooking time shorter ref. to improved quality of meat R more tender	4 max
	(b)	(i) mycoprotein / Quorn™ ;	1
		(ii) air lift (loop) fermenter ;	1
		(iii) wort ;	1
		(iv) rennin / rennet / chymosin ; R renin	1
		(v) ethanal / acetaldehyde ; R ethanol	1
			[Total: 9]

Question		Expected Answers	Marks
2	(a)	1 binary fission ; 2 increase in, size / volume / length ; 3 replication of <u>plasmids</u> ; 4 DNA replication (of nuclear zone) ; 5 semi-conservative ; 6 attachment to, mesosome / cell membrane ; 7 cell / cell membrane, lengthening (further) / AW ; 8 mesosomes / attachment points on membrane / AW, move apart ; 9 separating DNA molecules / AW ; 10 septum forming ; 11 cell wall, laid down / forming ; 12 further detail e.g. murein / peptidoglycan, molecules added, cross-links formed ; 13 two, identical / same-sized, cells produced ; 14 AVP ; 15 AVP ; e.g. increase in number / replication / synthesis, of organelles / ribosomes ref. to copy number of plasmids plasmid replication independent of nuclear zone replication / AW further detail semi-conservative replication membrane invaginates ref. to cytoplasmic division followed by cells separating resistance genes passed from original cell to new cells	max 7
		QWC – legible text with accurate spelling, punctuation and grammar ;	1

Question	Expected Answers	Marks
(b)	<p><i>benefit</i> <i>3 max for either</i></p> <p>useful in genetic, engineering / modification ; A recombinant DNA technology as a vector / description ; good vector for, bacterial / yeast hosts ; named example ; e.g. Ti plasmid and herbicide resistance gene good for gene transfer to, eukaryotes / higher organisms (e.g. herbicide resistance) ; description of use ; e.g. with <i>Agrobacterium tumefaciens</i></p> <p><i>harm</i></p> <p>unable to give, tetracycline / streptomycin / (relevant) antibiotic, to treat diseases ; (hence) spread of (infectious) diseases ; ref. to transfer of plasmids to other bacteria ; spread resistance / AW ; ref. multiple resistance ; A named example may possess unknown genes that code for 'harmful' product ;</p>	4 max
(c)	<p><i>assume answers are for mitosis unless otherwise stated</i></p> <p>ref. chromosomes becoming visible ; nuclear envelope, disassembling / reforming ; nucleolus, disappearing / reappearing ; spindle, presence / involvement ; centrioles present / involvement ; chromatids separating / centromeres dividing ; cytokinesis / description ;</p>	3 max
[Total: 15]		

Question			Expected Answers	Marks
3	(a)	(i)	same, concentration solution / water potential inside (cells), as outside / AW ; avoids osmotic problems / AW ; ref. to consequence if not equal concentrations e.g. lysis / shriveling ;	
		(ii)	avoids clumping of cells ; <i>ora</i> ref. to uneven distribution affecting count ; <i>ora</i> cells, easily damaged / fragile, so gently mixing ; AW	
		(iii)	allows cells, to settle (to bottom of chamber) / stop moving ; allows easier focusing (to count) ; <i>ora</i> idea of prevents counting errors if still moving ; <i>ora</i>	4 max
	(b)	<p><i>two marks for correct answer</i> 3 500 000 / 3.5×10^6 ; ;</p> <p><i>one mark if incorrect wrong count so ecf</i> <i>one mark if working correct or to 1mm^3</i></p> <p><i>example of correct working</i> 14 protoplasts in $0.2 \times 0.2 \times 0.1 \text{ mm}^3$ / 14 x 25 protoplasts in $1 \times 1 \times 0.1 \text{ mm}^3$ 350 protoplasts in 0.1 mm^3 3500 protoplasts in 1 mm^3 (<i>incorrect count of 12 gives 3000 at this stage</i>)</p>	2	
	(c)	<p>culture / growth / nutrient / M & S, medium ; A plant growth substances plant growth regulator / auxin / cytokinin ; <u>callus</u> culture ; subdivide ; provide light ; subdivide plantlets ; <u>sterile</u> soil ; AVP ; e.g. ref. to aseptic technique ref. to auxin / cytokinin ratio root / shoot, growth (from callus)</p>	4 max	
	(d)	<p><i>any one relevant advantage e.g.</i></p> <p>easier to manipulate genetically / AW ; virus-free ; easier for cell fusion ; described example e.g. potato eyes orientated correctly in culture medium ;</p>	1 max	

Qu. 3 cont.	Expected Answers	Marks
(e)	<p><i>1 mark for any valid variable</i> <i>1 mark for suitable justification - also give credit if realise that the different preparations may have different optima / operating conditions</i></p> <p>e.g. volume / mass / number, of cells (at start) ; number at start will influence number of possible protoplasts that can be formed ;</p> <p>(incubation) temperature ; temperature affects enzyme action ;</p> <p>enzyme, volume / concentration ; as enzyme concentration increases, may increase number of protoplasts formed ;</p> <p>sample size / volume counted in sample ; will affect number of protoplasts seen ;</p> <p>pH ; pH affects enzyme action ;</p> <p>age / condition, of fungal cells ; older cells more prone to autolysis / AW ; ora</p>	<p>2 max</p>

(f)	four max for description of results		6 max
	after 3 hours		
	C and D equal number of protoplasts ;	(so) (fungal) cell wall composed of chitin ; and glucan ;	
	greater / greatest, number protoplasts formed in, C / D, than, A / B ; ora	(so) cellulose not main component ; A only some cellulose / cell wall does not contain cellulose (so) more chitin than glucan ;	
B has, fewest protoplasts formed / fewer protoplasts than A ; ora			
after 6 hours			
fewer protoplasts formed in C than D ; ora A most protoplasts formed in D	lipase causes lowering of number of protoplasts formed ; lipase has effect on exposed (phospholipid) membrane / AW ; causes, lysis / rupturing / bursting, of cells (now that cell wall removed) ;		
enzymes, hydrolyse / digest, cell wall ; ref. to other components in preparation may have an effect ; ref. to absence of a control ; results are estimates ; ref. to replicates (lack of / no information given) ; AVP ; e.g. comparison of differences for each preparation from 3 to 6 hours D best preparation to use to obtain most protoplasts increase in number of protoplasts from 3 hours to 6 hours may have different results if left longer haemocytometry used so some (dead) cells may not be useable or results not conclusive to indicate efficiency of preparation			
[Total: 19]			

Question			Expected Answers	Marks
4	(a)	(i)	(mixture of) ethanol / ethyl alcohol, and, petrol / gasoline ; <i>treat % as neutral (Brazil = 22% and 78% ; elsewhere 10% and 90%)</i>	1
		(ii)	<i>any one relevant advantage e.g.</i> (combustion leads to) lower amounts, nitrogen oxide / CO ; no / reduced, sulphurous oxides ; A reduced acid rain any one health link for above ; partly / fully, renewable ; A renewable reduces need for fossil fuels ; reduced cost, qualified ; increased employment e.g. for sugar crop growing ; lowers / no, contribution to greenhouse effect ; (<i>CO₂ emitted cancelled by crops that use CO₂</i>) A carbon neutral lower volatile organic compounds ;	1 max
		(iii)	more productive ; continuous ethanol removal / lower concentration ethanol reduces inhibition of yeast growth ; reduced, cleaning time / less time spent in non-production ; less frequent sterilisation required ; smaller space required / smaller fermenter ; maintains culture in, a log / exponential, phase ; downstream processing easier / AW ;	2 max
		(b)	<i>immobilised - any valid reason for one mark, suitably qualified for second mark e.g.</i> <i>allow reference to more economical as qualification for reason</i> cells are separated from each other ; giving higher surface area ; <i>or</i> more even rate of ethanol production ; cells not lost in product removal ; so cells easily recovered ; cells held in matrix ; so cells can be reused ; no / fewer, cells in product ; so easier downstream processing / easier to separate product ; greater protection from extremes / AW ; A example described so improved stability ; may give a longer shelf-life of cells ; less need for frequent re-stocking ; <i>or</i> can use a smaller, volume / number, of cells ;	2 max

Qu. 4 cont.	Expected Answers	Marks
(c)	<p><i>one mark for relevant favourable feature second mark for reasonable explanation third mark for comparable data quote</i></p> <p>J can use the largest range of (respiratory) substrates ; greater choice of feedstock / feedstock to suit area or country ; AW data comparison ;</p> <p>or K highest ability to flocculate ; easier to remove cells at end of fermentation ;</p> <p>alternative for above able to ferment at lowest temperature ; cost saving for heating fermenter ;</p> <p>data comparison ;</p> <p>or L able to ferment at the highest temperature ; more tolerant to extremes of temperature ; data comparison ;</p> <p>or M highest tolerance to ethanol ; able to survive and produce more ethanol ; data comparison ;</p> <p>AVP ; e.g. additional reasonable explanation use of data comparing other features to support choice</p>	3 max
(d)	<p><i>any one valid</i></p> <p>unable to scale-up ; more, side / by, products ; greater costs involved ; more prone to mutation ; unable to operate in continuous fermentation ; problems with immobilisation ;</p>	1 max

Qu. 4 cont.		Expected Answers	Marks
	(e)	(i)	
		<p><i>assume answers refer to oleic acid unless stated</i></p> <p>longer / 18 to 16 C / more CH₂ groups ; unsaturated / double, bond ;</p>	2
		(ii)	
		<p>oleic acid, is a <u>fatty acid</u> / possesses, fatty acid / hydrocarbon chains ;</p> <p><i>support</i> fatty acid tail / hydrocarbon chain, is hydrophobic ; longer tails gives, more hydrophobic interaction / increased hydrophobic core / greater repulsion of water molecules ; greater membrane stability / AW ; fewer problems with ethanol as solvent (affecting membrane) ; increase in oleic / replacement of palmitic, correlates with increased, tolerance / ethanol concentrations ; increased distance reduces rate of entry of ethanol into cell ;</p> <p><i>not support</i> double bond gives 'kink' in tail / AW ; phospholipids / fatty acid tails (of adjacent phospholipids), further apart / increases fluidity ; gives more 'gaps' / makes more leaky ; there may be other reasons for increase in oleic ; presence of hydrophobic core does not affect entry of ethanol molecules / AW ;</p> <p>AVP ; <i>credit all relevant points</i></p>	3 max
		(iii)	
		<p>similar, function to / role as, cholesterol (in membrane) ; provides stability to membrane (structure) ; regulates membrane fluidity / decreases fluidity ; ref. to hydrophobic, nature / interaction ; helps to prevent entry of ethanol ;</p>	2 max
			[Total:17]

Question		Expected Answers	Marks
5	(a)	<p>P = reverse transcriptase ; Q = <u>DNA</u> polymerase ; R = restriction, enzyme / endonuclease ;</p>	3
	(b)	<p>any valid suggestion ; e.g. polypeptide / protein, too long / large, to sequence amino acid sequence not, fully determined / known nucleotide sequence too long easier / cheaper, to use restriction enzymes</p>	1
	(c)	<p>(i) <i>all correct = 3 marks</i> <i>deduct 1 mark each incorrect triplet</i> <i>sequences correct but RNA for DNA, one mark only</i></p> <p>AUG UU^U/_C CC^{U/C}/_{A/G} AC^{U/C}/_{A/G} AU^{U/C}/_A TAC AA^A/_G GG^{A/G}/_{T/C} TG^{A/G}/_{T/C} TA^{A/G}/_T</p>	3 max
	(ii)	<p>code degenerate ; 64 possible codons for only 20 amino acids ; (some) amino acids specified by more than one, codon / (base) triplet / different, codons / (base) triplets, can code for the same amino acid ; so different nucleotide sequences (in a gene) may still give the same amino acids ; correct example from Table 5.1 ;</p>	2 max
	(d)	<p>S = diabetes (mellitus) ; T = haemophilia ;</p>	2

Qu. 5 cont.	Expected Answers	Marks
(e)	<p><i>can gain marks from a flow diagram or table correctly constructed max 5 for either description(d) or explanation (e) b = description / explanation</i></p> <p>extract <u>mRNA</u> from, β cells / pancreas / islets of Langerhans ;</p> <p>1d organ / tissue / cells, that synthesise insulin ;</p> <p>2e ref. to introns and use of mRNA ;</p> <p>3e use reverse transcriptase to synthesise, (complementary / copy / c) DNA</p> <p>4b strand ;</p> <p>5b use DNA polymerase to synthesise, gene coding for insulin / dsDNA ; A duplex</p> <p>6d plasmid, cleaved / cut open, using, restriction endonuclease / enzyme ;</p> <p>7e use plasmid to act as a vector ;</p> <p>8d (add) 'sticky ends' / lengths of ss DNA / nucleotides (to plasmid / gene) ;</p> <p>9d so that gene inserts by complementary base pairing ;</p> <p>9e DNA ligase ;</p> <p>10d to seal sugar-phosphate backbone / AW ;</p> <p>11e plasmid carrying markers / genes, for resistance to, antibiotic / named</p> <p>12d antibiotic/s ;</p> <p>13d resistance gene destroyed when gene inserts ;</p> <p>14e so allows identification of recombinant host / AW ;</p> <p>15d gene introduced into, (prokaryotic) host / bacterial cell ;</p> <p>16b <i>Escherichia coli</i> used as host (for insulin production) ; A <i>E. coli</i></p> <p>17 AVP ;</p> <p style="padding-left: 20px;">e.g. centrifugation for mRNA extraction correct reference to gene splicing making hosts competent e.g. presence of calcium ions ref. to source of plasmid correct method for screening gene coding for insulin inserts at end of lac operon sticky ends are, GGG (gene) / CCC (plasmid) TTT not used because it folds</p>	7 max
	<p>QWC – clear, well organised using specialist terms ;</p> <p>three from one location (β cells / pancreas / islets of Langerhans), introns, any two enzymes (for two terms), complementary, base-pairing, plasmid, vector, sticky ends, gene splicing, marker genes, recombinant, prokaryote, centrifugation, operon</p>	1
		[Total: 19]

Question		Expected Answers	Marks
6	(a)	<p>two marks for correct answer 400 000 ; ; (19mm = 380 000) (21mm = 420 000)</p> <p>one mark if image length / actual 20mm (+/- 1mm) / 50 nm $20 \times 10^{-3} / 50 \times 10^{-9}$</p>	2
	(b)	wild-type has tail fibres ; ora	1
	(c)	by the tail pins (to receptor on <i>E. coli</i>) ; A description of base plate / tail pins	1
	(d)	<p>both DNA ; both similar size ; both circular ; ref. to circularisation of bacteriophage DNA ;</p>	2 max
	(e)	<p>e.g. 1 mark for each word in bold to max 5</p> <p>The complex (;) virus(;) has a capsid(;) which is made of 72 capsomeres(;) and contains DNA / nucleic acid (;). It acts to infect a bacterium / bacteria (;) known as <i>E .coli</i> and unlike the HIV / human immunodeficiency virus(;) does not have an envelope (;)</p> <p>2nd mp A bacteriophage / phage for virus 6th mp A prokaryote for bacterium 7th mp A retrovirus for HIV last mp A membrane / phospholipid bilayer for envelope</p>	5 max
			[Total: 11]

2805/05 Mammalian Physiology and Behaviour

Question			Expected Answers	Marks
1	(a)	(i)	1. large / moveable, pinnae ; A outer or external ear 2. direct / collect, sound waves / (air) vibrations ; 3. differences in, loudness / timing, between two ears ; 4. eyes, at front (of skull) / forward facing / large ; 5. fields of vision overlap / 3D vision / stereoscopic vision ; 6. judge distances more accurately / AW ; 7. ref. to keen sense of smell ; 8. AVP ; e.g. whiskers detect vibrations	4 max
		(ii)	large surface area (for heat loss) / ref. to blood supply ;	1
	(b)	1	recessive <u>allele</u> for deafness ; R gene	
		2	symbols and key ; <i>penalise wrong symbols once</i>	
		3	heterozygous parents / carriers (for deaf allele) ; R gene	
		4	gametes ;	
		5	offspring genotypes ; A deaf offspring gets recessive allele from each parent	
		6	phenotypic ratio ; A 25% deaf	
		7	ref. to mutation ;	4 max
	(c)		swallow / yawn, opens <u>Eustachian</u> tube ; air can move in or out of middle ear / equalisation of air pressure (either side of ear drum) ;	2
				[Total:11]

		<p>(ii) water / solute, potential (in lumen) lowered ; less than, (epithelial) cells / mucosa ; water passes, down / across, water / solute, potential gradient / high to low / AW ; R along</p>	<p>2 max</p>
		<p>(e) stop / reduce, <u>peristalsis</u> ; R no longer contracts food / faeces, move more slowly / AW ; more time for water to be absorbed / more water absorbed ; less ions secreted into lumen therefore less decrease in, water / solute, potential ;</p>	<p>2 max</p>
			[Total:18]

Question			Expected Answers	Marks
3	(a)	(i)	1. osteoclasts (in ribs) ; 2. put, calcium / Ca^{2+} , (from bone) into blood ; 3. osteoblasts (in skull) ; 4. take up, calcium / Ca^{2+} (from blood) ; 5. ref. to hormones ; e.g. calcitonin / parathormone <i>penalise Ca / Ca^+ once</i>	3 max
		(ii)	calcium phosphate / $\text{Ca}_3(\text{PO}_4)_2$; forms approx 60% of bone mass / bone is mineralised ; A two thirds hard ; provides rigidity ; compressive strength ;	3 max
	(b)		amine group / NH_2 , instead of OH ;	1
	(c)		<i>(pain)</i> 1. more pain relief with, glucosamine / NSAIDs ; 2. no difference between glucosamine and NSAIDs ; <i>(cartilage gap)</i> 3. reduction in cartilage gap less with glucosamine / ora ; 4. less degeneration with glucosamine / glucosamine helps make cartilage ; 5. ref. to link between gap and pain ; e.g. decrease in gap leads to more friction 6. placebo effect described ;	4 max

(d)	1	Ca ²⁺ diffuse from sarcoplasmic reticulum ; <i>ignore T tubules</i>	7 max
	2	Ca ²⁺ bind to troponin ;	
	3	troponin changes shape ;	
	4	tropomyosin moves away from myosin binding site ;	
	5	on actin ;	
	6	myosin binds to actin / cross bridges form ;	
	7	myosin head tilts / AW ;	
	8	ADP and Pi released ;	
	9	ATP binds to myosin head ;	
	10	ATP hydrolysed ;	
	11	energy released ;	
	12	myosin head released from actin ;	
	13	cycle repeated ;	
	14	AVP ; e.g. (myosin head) ATPase / shortening of H or I / Z lines closer	
	<i>penalise calcium / Ca / Ca⁺ once</i>		
	QWC – clear well organised using specialist terms;	1	
	<i>any 3 from: sarcoplasmic reticulum, troponin, tropomyosin, actin, myosin, hydrolysis.</i>		
			[Total:19]

Question		Expected Answers	Marks
4	(a)	1. ref. photoreception of (bright) light / AW ; 2. action potentials / impulses, to brain ; 3. action potentials / impulses, along parasympathetic nerves / vagus (to iris) ; 4. circular muscles contract ; 5. radial muscles relax ; 6. ref. acetylcholine (at n.m. junction at end of psn) ;	3 max
	(b)	(i)	
		as time increases percentage of people correctly identified as being over legal limit decreases / AW ; non-linear relationship / AW ; comparative figs ;	2 max
		(ii)	
		non-invasive ; do not need medical staff or laboratory / can be done 'on the spot' ; no risk of infection ; less expensive ; immediate result / quicker ; avoids needle phobias ; gives better indication of reaction time :	2 max
	(c)	1. ethanol oxidised ; 2. NAD accepts hydrogen / NAD reduced ; 3. ethanol / alcohol, dehydrogenase ; 4. to ethanal ; 5. ref. ethanal / (acet)aldehyde, dehydrogenase ; 6. ethanoate / acetate / acetyl coA ; 7. enters Krebs cycle ; <i>ignore location in cells</i>	4 max

	(d)	1. excess / too much, reduced NAD ; 2. less NAD for other reactions ; 3. dehydrogenation / oxidation, of fatty acids cannot take place / fatty acids cannot be broken down ; 4. fatty acids accumulate ; 5. converted to, fats / lipids / triglycerides ; 6. acetyl coA used for fatty acid synthesis ;	3 max
			[Total:14]

Question			Expected Answers	Marks
5	(a)	(i)	A – <u>centrum</u> ; B – <u>neural spine</u> ;	2
		(ii)	side X – because of position of, neural spine / ribs / aorta ;	1
	(b)		separate <u>centra</u> (of two vertebrae) ; allow, movement / bending / flexibility ; shock absorbers / cushioning ; reduce friction / prevent damage ;	2 max
	(c)		divide by mitosis ; <u>differentiation</u> ; become, neurones / other named cells ; AVP ; e.g. stimulated by, surrounding / damaged, tissue or genes switched, on / off	2 max

(d)	1 2 3 4 5 6 7 8 9 10 11 12	<i>(symptoms any 3 from)</i>		8 max
		;;; ;		
		(increasing) loss of memory	difficulty in concentration	
		increase in anxiety	personality changes	
		hallucinations / paranoia	decline in cognition / understanding	
		lose ability to recognise people	disorientation / confusion	
		loss of speech	loss of coordination	
		<i>(treatment)</i>		
		(enzyme) inhibitors ;		
		of acetylcholinesterase ;		
		slows reduction in acetylcholine / allows synaptic transmission ;		
		(inhibition) of enzyme that converts APP to $A\beta_{(42)}$; R $A\beta_{(40)}$		
reduces quantity of $A\beta_{(42)}$ made ; R $A\beta_{(40)}$				
vaccine to break down plaques / named drug ; e.g. exolon / reminyl / aricept / ebixa				
<i>(prevention any 3 from)</i>				
;;; ;				
keep brain active	e.g. of mental activity			
avoid blows to head	plenty of exercise			
learning new skill	named, dietary ingredient / remedy			
QWC – legible text with accurate spelling, punctuation and grammar;			1	
[Total:16]				

Question		Expected Answers	Marks
6	(a)	(i) <i>(description)</i>	5 max
		1 time between lever pressings decreased / AW ;	
		2 comparative figs ;	
		<i>(explanation)</i>	
		3 rat was hungry ;	
		4 operant conditioning ;	
		5 trial and error learning ;	
		6 associative learning ;	
		7 lever pressing produces reward ;	
8 reinforcement ;			
		(ii) same apparatus or rat of same, species / age / gender or conditions kept the same ;	2
		no food / no reward ;	
		(iii) time between lever pressings, random / no pattern ;	1
(b)	1	temporary / permanent / reversible / irreversible ;	4 max
		<i>(competitive)</i>	
		2 shape, similar to substrate / complementary to active site ;	
		3 blocks / binds to, active site / AW ;	
		<i>(non-competitive)</i>	
		4 shape different from substrate ;	
		5 fits, allosteric site / different part of enzyme ;	
		6 changes shape of / alters, active site ;	
		7 fewer, enzyme substrate complexes / ESCs ;	
8 reduces rate of reaction / less product formed ;			
			[Total:12]

2806/01 Unifying Concepts in Biology - Written Paper

Question		Expected Answers	Marks
1	(a)	1 lemming / reindeer ; 2 bear / wolf / reindeer ; 3 Irish hare / red squirrel / red deer ;	3
	(b)	1 interbreeding / mating together ; 2 possible between red deer & Sika / not between red deer & fallow ; A Latin names 3 red and Sika, same <u>genus</u> / both <u>Cervus</u> ; 4 red and Sika closely related / red and fallow not closely related ; 5 AVP ; e.g. gamete incompatibility / different chromosome numbers / non-overlapping breeding season / isolating mechanisms	3 max
	(c)	26 / 53 X 100 ; 49 % ; <i>wrong figs correct method max 1 ecf</i>	2
	(d)	1 fewer <u>species</u> arrived ; 2 via, ice / land, bridge ; 3 Ireland further away from continent / harder to reach ; AW 4 ice melted / Ireland cut off, earlier ; 5 smaller land mass (supports fewer species) ; R fewer mammals / smaller populations 6 AVP ; e.g. problems of small populations / S. England supported additional species	2 max
	(e)	<i>Irish hare (A reverse argument for brown hare)</i> shorter ears ; A smaller redder / darker, coat ; A colour difference described smaller size / shorter head ;	2 max
	(f)	1 geographical isolation / allopatric speciation ; A described 2 different, conditions / environments / selection pressures ; 3 e.g. detail (camouflage / food sources / competition) ; 4 different / changing, allele frequency / mutation ; 5 ref. founder effect / original, animals / gene pools, different ;	3 max
			[Total: 15]

Question		Expected Answers	Marks	
2	(a)	<p><i>description</i></p> <p>D1 (%) underweight, decreases / no change ; D2 (%) acceptable decreases ; D3 (%) overweight, no significant change / fluctuates ; D4 (%) obese increases ; D5 data quote change with years ; DESCRIPTION MAX 3</p> <p><i>explanation</i></p> <p>E1 food cheaper / portions bigger / less home cooking / more convenience food ; E2 more car journeys / less exercise / less manual labour ; E3 AVP ; e.g. warmer homes, less sleep, more alcohol consumption</p>	5 max	
	(b)	<p>fewer men acceptable, & / or, underweight ; (in 2003) 33 % men cf. 43% women ; more men overweight (& obese) ; (in 2003) 67% men cf. 57% women ;</p>	2 max	
	(c)	(i)	<p>as a control / as a (normal) standard ; for comparison ; ref. other variables / psychological effect ; half of sample so equal numbers in each group ;</p>	2 max
		(ii)	<p>this amount of, fluctuation / individual differences, expected ; by chance ; change in placebo groups <u>within</u>, normal range / + or -2 ; statistical tests showed change, not significant / 95% likely to be by chance ;</p>	2 max
		(iii)	<p>obesity increases CVD (as well as diabetes) ; AW high cholesterol is linked to cardiovascular disease / heart attack / stroke ; insulin involved in lipid metabolism ; most diabetics have high blood cholesterol ;</p>	2 max

	(d)	<p>1 (MHCP) lowers (blood) glucose levels ; A cinnamon 2 data quote in support ; 3 MHCP, mimics insulin / same shape as insulin ; 4 MHCP, complementary shape to / binds to, receptor ;</p> <p>5 causes cells to, take in / use, glucose ; 6 increases glycogen, synthesis / storage ; 7 in liver / muscle ; 8 detail of 2^o messenger cascade effect ;</p> <p>9 (diabetic) may lack insulin ; 10 insulin resistance / cells do not respond to insulin ; 11 (reduces) named symptom ; e.g. loss in urine / thirst / salt loss / hunger / tiredness 12 hyperglycaemia / hypoglycaemia ; 13 coma explained ;</p> <p>14 ref. keto acids / altered lipid metabolism ; 15 data quote for, triglyceride / cholesterol ;</p> <p>16 AVP ; ; e.g. 1 - 1g cinnamon, sufficient / as effective as 6g 17 e.g. 2 - cinnamon can replace insulin therapy e.g. 3 - cinnamon or MHCP by mouth (not injection) e.g. 4 - named enzyme e.g. 5 – comment re. suitability of rat model</p>	7 max
		QWC – legible text with accurate spelling, punctuation and grammar;	1
			[Total: 21]

Question			Expected Answers	Marks
3	(a)	(i)	<p><i>DNA</i></p> <p>nucleotides / sugar + phosphate + base ; phosphodiester bonds ; double stranded / double helix ; 4 subunits / A,T,C and G ;</p>	<p><i>protein</i></p> <p>amino acids ; peptide bonds ; ref. 2° / 3° / 4°, structure ; 20 subunits ;</p> <p>2 max</p>
		(ii)	<p>cytoplasm ; cell membrane ; cell wall ; ribosomes ; circular DNA ; glycogen granule / oil droplet / food store ; AVP ; A slime capsule / mesosome / pili / flagellum / named bacterial function</p>	3 max
	(b)	(i)	disulphide ;	1
		(ii)	deoxyribose / sugar ; R incorrect named sugar	1
	(c)	(i)	<p>to, mark / label (molecules) ; to make (DNA and protein), traceable / trackable ; to distinguish DNA and protein ; AW</p>	2 max
		(ii)	<p><i>Experiment 1</i> radioactive DNA / radioactivity, found in offspring ; therefore DNA passed from parents to offspring ; AW</p> <p><i>Experiment 2</i> radioactivity not found in offspring ; therefore, protein left in coat / not passed on ; AW</p>	3 max
				[Total: 12]

Question		Expected Answers	Marks	
4	(a)	<p><i>DNA</i></p> <p>mutation ; altered protein synthesis ; problem with, DNA replication / cell division ; ref. cancer ;</p> <p><i>proteins</i></p> <p>denatured ; altered, 3D / tertiary / quaternary, shape ; ref. active site / specificity ; ref. protein function or named protein ; (e.g. enzyme / receptor / hormone) (max 3 either section)</p>	4 max	
	(b)	(i)	<p>not supported ; mole rat has, low reduced:oxidized ratio / low % reduced ; ora for mouse (mole rat) high / more, free radicals / damage ; ora for mouse</p>	3
		(ii)	<p>D mice and mole rats different ages ; E mole rats had more time to, metabolise / experience free radical damage ;</p> <p>D mole rats usually live, underground / in low O₂ conditions ; E exposed to abnormally high O₂ in lab ;</p> <p>D organisms not perfectly matched for, size / hair cover ; E mole rats have lower BMR ;</p> <p>E not, comparable / fair test ; A once with any stated difference</p>	4 max
	(c)		<p>curve drawn to the left of mouse ;</p>	1
			[Total: 12]	

2806/03 Practical Examination

A2 Biology. Planning exercise

Checking point	Descriptor	The candidate
A	P.1a	Plans a suitable procedure that involves preparing a calibration curve for urea concentrations and using it to determine urea in urine samples from people on diets with different quantities of protein (minimum of two diets) ;
B	P.1a	Gives a prediction about excretion of urea (in the urine) with increasing protein intake ;
C	P.1b	Selects suitable equipment and materials to include water bath, graduated pipette / burette / syringe, named pH indicator / pH probe / pH meter ;
D	P.3a	Describes <u>deamination</u> of amino acids and production of urea from ammonia (in the liver / hepatocytes) ;
E	P.3a	Identifies at least 2 key factors to control either in making the calibration, e.g. duration, conc of urease, conc of indicator, temperature, volumes (NOT pH) or 2 key factors in the selection and treatment of subjects ; this can be awarded in the method
F	P.3b	Decides on a minimum of five different concentrations of urea with a range that includes at least one concentration greater than 2.5 g per 100 cm ³ ;
G	P.3b	Decides on appropriate number of protein diets to use: minimum of five different protein diets – described qualitatively or quantitatively ;
H	P.3b	Describes way of obtaining reliable results for the calibration curve by repeating each concentration twice / carrying out three replicates ;
I	P.5a	Uses appropriate A2 scientific knowledge and understanding in developing a plan ; e.g. explains how urea is eliminated from the body – <u>liver / hepatocytes, blood, kidney</u> / explains how final concentration of urea in urine is determined (ref ADH, permeability of collecting ducts) / use of information about nitrogen balance
J	P.5a	Uses , results or observations from preliminary work or previous practical work in developing a plan ;
K	P.5a	Refers to at least one safety aspect (hazard and precaution) ;
L*	P.5b	<i>Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC) ;</i>
M	P.5b	Describes a way of generating precise results ; e.g. use of uniform background to see end point
N	P.7a	Uses information from at least two identified secondary sources , e.g. text book, web site, article, class notes, etc ;
O*	P.7a	<i>Uses spelling, punctuation and grammar accurately (QWC) ;</i>
P	P.7a	Shows how results from testing urine are to be presented in the form of a table with all relevant units ; <i>may be table for all protein diets or just one + HCl / urea conc.</i>
Q	P.7a	Uses information about quantity of dietary protein from AS in developing plan ;
R	P.7b	Describes / shows / indicates, how calibration graph would be used to find concentration of urea excreted ;
S	P.7b	Explain that urea concentration of urine fluctuates therefore collect more than one sample / collect over a day / use morning sample ;
T	P.7b	Describes / shows, how to display graph of urea excreted against protein in diet ;

U	P.7b	Recognises that variable(s) cannot be controlled when using human subjects ;
V	P.7b	Shows how to calculate the mass of urea excreted per unit time ;

Point mark up to **14** by placing letters A to U **excluding L and O** in the margin at appropriate points.

Then award **1** mark for each of **L** and **O** (QWC).

Total: 16

Further elaboration of checking points

A	Suitable methods: 1. hydrolyse urea completely, titrate against HCl using a suitable indicator; 2. hydrolyse using urease, and follow course of reaction with a suitable indicator until an end point – this method was Q.1 June 2006. 3. Direct titration without calibration (see page 6). Protein diet may be qualitative (high /low) or quantitative R this checking point if titration is carried out <i>less than 10 minutes</i> after adding urease, but A if checked to constant pH
B	Could be given for a sketch graph. Axes must be labelled. A concentration of urea. Units and values on the axes are not expected for this checking point. May award with T
C	Temperature – water bath , volume – burette / graduated pipette / syringe, monitoring pH – named indicator / pH probe / pH meter
D	This may be a diagram. If a source is cited then this contributes to N A recognisable misspellings of deamination
E	Variables may be taken from a table, a list or from the method. Variables for the people could be age / sex / height / weight (mass) / exercise but not lifestyle / health unqualified
F	Concentrations must be given . These may be % or g dm^{-3} . For direct titrations see page 6. R a table that only shows dilutions and does not show concentrations
G	Protein diets can be 'very high, high, average, low, very low' or given in terms of mass of protein per day or described in terms of grams of protein per kg body mass per day
H	Look for this in the method to give the calibration graph
I	If urea elimination, then this to include urea from liver to blood, transport in the blood, (ultra) filtration (reabsorption) and formation of urine.
J	There must be some indication that they have done something and then what they have done about it. 'It was too slow so I decided to use a water bath at 37 °C' is an example of the minimum acceptable answer
K	0.1 ml dm^{-3} HCl - corrosive / irritant; indicators – low hazard but accept harmful/irritant; urease – accept ref to allergies; refs to health risks of handling urine, use gloves; A NH_4CO_3 - irritant
L*	Lengthy, rambling, incoherent, illogical plans that you have to read two or three times don't get this one. 'Amount' used for volume may be a reason for not awarding this, but do not penalise both L and O if well structured with headings, tables, graphs, etc. R for incorrect colours of indicators, also R if only one part of the investigation is covered
M	Other ideas: gives degree of uncertainty in using burette – +/- 0.05 cm^3 or less which may be expressed as a percentage error; rough titration followed by two concordant results; use of colour standard
N	The sources must be cited in the text – either in full or with a number that refers to a bibliography
O*	Use your professional judgement here. Use the standardisation scripts as a guide. Ignore a few minor slips or one or two consistent errors.
P	Table should have protein (+/- units), volume of HCl / conc of urea + unit in heading
Q	This is likely to be clear statement about using protein RNI, RDA, RDI, etc
R	Shown on calibration graph or described. Direct titrations – see page 6.
S	Change in water excreted, change in urea excreted over time
T	If a graph is described then dependent variable comes first: '...draw a graph of urea excreted / AW against protein intake' Obviously accept refs to x/horizontal and y/vertical. Units are not necessary. May award with B

U	One or more variables that are difficult to control. Not for commenting on variables that are then controlled in the plan
V	Converting concentrations into mass of urea per unit of time such as per day

Adapt the mark scheme for those who carry out 'direct titrations' where candidates plan to add urease to the urine sample, allow time for hydrolysis, titrate HCl against the ammonium carbonate and then use the results to calculate the concentration of urea. Chemists may do this. It is perfectly valid and must score the same marking points as the 'draw a calibration curve' method.

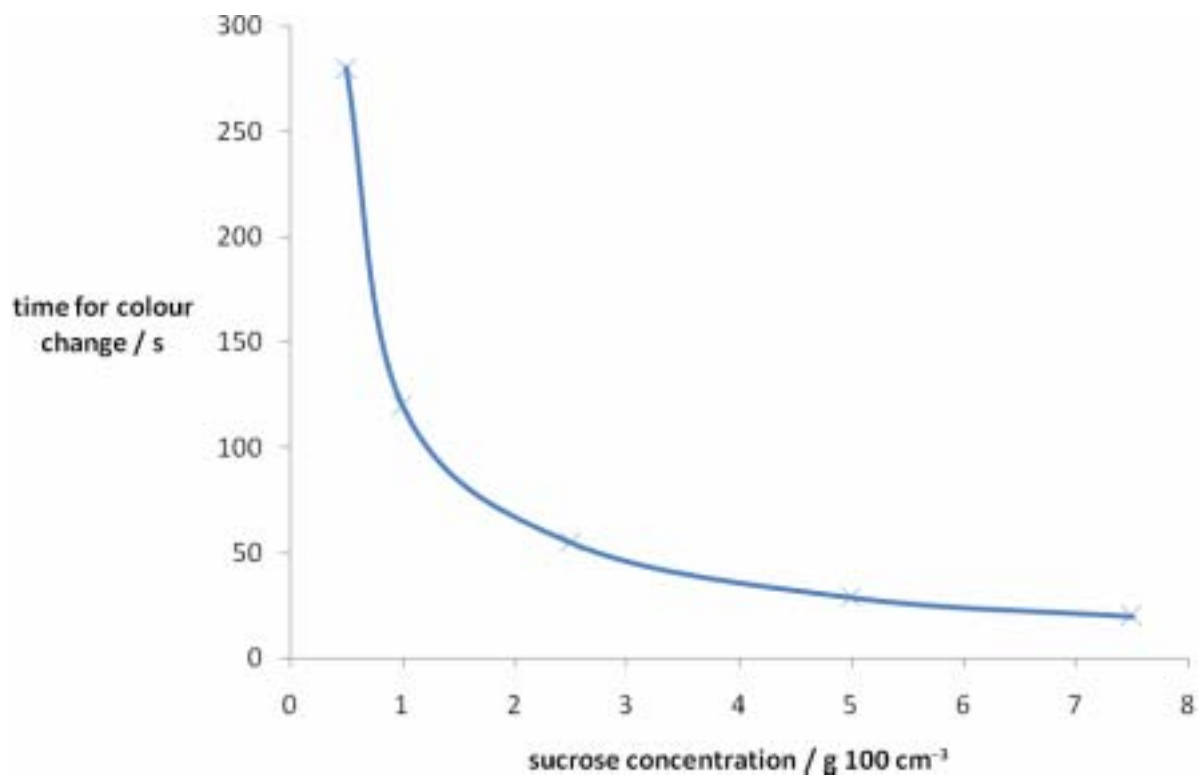
- A** Plans a suitable procedure that involves determining the urea concentration in urine samples by titration. Minimum of two protein diets. Urea and urease must be left for a minimum of ten minutes or pH checked to see if it is constant.
- F** States that 2 mol of HCl is equivalent to 1 mol of urea
- H** Plans to carry out replicates, as follows:
- divide each batch of urine into three separate reaction mixtures and carry out a titration with each one
 - set up one reaction mixture and take 3 samples from it for 3 titrations
- If they do one (rough) titration and then continue until they get 2 results that are concordant or very close (or whatever) then that is H. It is also M.
- L** Do not penalise for the lack of a calibration graph if they use this method.
- R** Shows how to calculate the concentration of urea from titration results.

Apply the other marking points as per page 4.

Example of expected results for **(a)**

tube	concentration of sucrose / g 100 cm ⁻³	time to show colour change / s
A	7.5	20
B	5.0	29
C	2.5	55
D	1.0	120
E	0.5	280
F	unknown	72

Example of expected graph for (b)



Question		Expected Answers	Marks
1	(a)	<p>table format with column / row headings - concentration of sucrose, <u>time taken for colour change</u> ; R time unqualified <i>ignore tube label</i>, F has no concentration</p> <p>units in column / row headings ; g 100 cm⁻³ and minutes / seconds</p> <p>R if units in body of table <i>ecf if concentration of sucrose not given</i></p> <p>time recorded in seconds ;</p> <p>results for all six tubes ;</p> <p>tube A fastest ;</p>	5
	(b)	<p><i>accept graphs that show rate with 1000/t or equivalent as the rate unit</i></p> <p>1 axes correct with concentration of sucrose on horizontal axis <i>even if not labelled</i> ;</p> <p>2 axes scaled – x = at least 7.5 cm, y = at least 12 cm ;</p> <p>3 <i>no need to start at 0,0</i></p> <p>4 axes labels with units – concentration / g 100 cm⁻³ <i>and</i> time / s ;</p> <p>5 points plotted accurately ; A +/- half a small square <i>circle any mistakes</i></p> <p>appropriate line of best fit ;</p> <p>R if extends beyond first and last point unless used for estimating F</p> <p>6 A 'dot to dot' if ruled</p> <p>intercept shown on the graph for F ;</p>	6
	(c)	<p>concentration determined correctly from the graph ;</p> <p>results in correct range = 1.5 – 2.5 ;</p> <p>g 100 cm⁻³ / % ;</p>	3
	(d)	50 (mg cm ⁻³) ; <i>if not in table look for this in the calculation</i>	1
	(e)	<p><i>award two marks for the correct answer (119)</i></p> <p><i>if incorrect answer given, allow one mark for writing out the calculation correctly allowing ecf from (d)</i></p> <p>119 ;; A range 119.0 to 121.5</p> <p>concentration of sucrose in the urine = 50 mg cm⁻³ / A <i>ecf</i></p> <p>urine formation rate = 1.67 / 1.7 cm³ min⁻¹</p> <p>(concentration of sucrose in the blood = 0.7 mg cm⁻³)</p> <p>filtration rate = $\frac{50 \times 1.67}{0.7} = 119 \text{ cm}^3 \text{ min}^{-1}$ A 100/60 for 1.67</p>	2
	(f)	<p><i>idea that concentration (of sucrose) depends on <u>volume of water</u> excreted</i></p> <p>;</p>	1
	(g)	<p>sucrose is a non-reducing sugar ;</p> <p>(HCl) breaks <u>glycosidic</u> bond ; R <u>glucosidic</u></p> <p>by <u>hydrolysis</u> ;</p> <p>to produce, glucose / fructose / monosaccharide(s) / reducing sugars ;</p> <p>correct descriptions of reaction with Benedict's solution ; e.g. Cu(II) → Cu(I)</p> <p>boiling, increases rate of reaction / provides energy for breaking bonds / reduces activation energy / AW ;</p>	3 max

	(h)	<p>reducing sugar test</p> <p>1 not all sucrose may be, hydrolysed / broken down ; 2 time for hydrolysis varied (cannot neutralise all simultaneously) ; 3 difficult to control temperature of water bath (at 55 °C) / should have used thermostatically-controlled water bath ; 4 some acid may remain / did not test with pH indicator to check contents were neutralised ; 5 result taking, depends on identifying colour change / ref to subjective ; 6 no colour standard to judge colour / AW ; A use white background to help judge colour R use a colorimeter 7 AVP ; R stirring / shaking</p> <p>procedure</p> <p>8 only <u>five</u> results ; R 'use more concentrations' unqualified 9 changes occur too fast to measure accurately ; 10 <i>idea that</i> small difference in timing results in difference in estimate of sucrose concentration ; 11 need a wider range / ora ; 12 more intermediates / ora ; 13 to be sure of line of best fit / AW ; 14 ref to contamination of sucrose solutions ; e.g. with syringe / glass rod 15 ref to accuracy using syringe ; e.g. using 10 cm³ syringes to deliver 1 cm³ / air bubbles / use burette / use graduated pipette ; R 'sticky plungers'</p> <p>16 no repeats / should be repeated ; 17 calculate mean / standard deviation ; A average 18 AVP ; e.g. no initial attempt to observe colour change</p>	6 max
	(i)	<p>taking samples</p> <p>1 only carried out the procedure on one person / ora ; 2 may be variation in filtration rate over time for an individual ; e.g. time of day / activity 3 may be variation in filtration rate between individuals ;</p> <p>4 biology sucrose is, inert / not hydrolysed <i>or</i> respired <i>or</i> synthesised into larger molecules ; 5 6 A 'not changed' R sucrose is not used in the body (it's in the 7 question) 8 no sucrose in, blood / tissues ; A ' there is no enzyme that works on 9 sucrose' 10 (method is) invasive / involves injection ; sucrose filtration rate may not be typical ; (after filtration) sucrose may be, reabsorbed / added to urine / AW ; ref to blood pressure ; AVP ; sufficient time (60 mins) is left for sucrose to appear in urine ref to glucose in urine accounts for environmental conditions (e.g. temperature and sweating) ref to fluid intake having no effect on the rate ref to decrease in, water potential / solute potential, effect on filtration</p>	6 max
			[Total: 28]

Question		Expected Answers	Marks
		<i>In the drawings circle areas that do not have clear continuous lines</i>	
2	(a)	<p><i>drawing</i> LP plan (no cells) with at least 5 capsules drawn ; R dots for capsules clear, continuous lines ; uneven distribution of capsules ; different sizes of capsules and capsules not all circular ;</p>	4
	(b)	<p><i>drawing</i> draws complete section (in TS) with clear continuous lines ; R if any shading / lines to represent microvilli / open ended / more than one tubule 2 – 8 nuclei ; at least three nucleoli ; A dots / blobs 3</p> <p><i>labels – tick to max 4 and then stop</i></p> <p>nucleus ; nucleolus / chromatin / AW ; brush border / striated border / microvilli / AW ; R cilia lumen ; cytoplasm ; epithelium ; basement membrane (only if shown outside cells) ; R basal membrane 4 max</p> <p><i>annotations</i></p> <p>(nucleus) – purple / blue ; A ref to contrast (e.g. nucleus/nucleolus darker than cytoplasm) (nucleolus) – dark, purple / blue ; (cytoplasm) – red / pink / orange ; (basement membrane) – purple / blue ; cuboidal / AW ; 2 max</p>	9
	(c)	<p><i>question asks for structure – size is neutral assume answer refers to medulla unless told otherwise</i></p> <p>no, renal capsules / Bowman's capsules ; no glomeruli ; no convoluted tubules ; longitudinal orientation of tubules / AW ; A vessels tubules run parallel / AW ; A vessels (tubule) cells have no, microvilli / brush border ; loops ; collecting ducts ; vasa recta / AW ;</p>	2 max
	(d) (i)	<p><i>award two marks if correct answer (7 μm) is given if answer is not 7 μm, allow one mark for dividing a measurement by 7500</i></p> <p>7 μm ;; accept 0.0007 cm / 7 x 10⁻⁴ cm / 0.007 mm / 7 x 10⁻³ mm, etc</p>	2

		(ii) provide much, ATP / energy ; active transport / AW ; sodium potassium pump ; selective reabsorption / determining concentration of ions in urine / Na ⁺ into blood ; AVP ; e.g. any detail of reabsorption / active transport / movement of vesicles / carrier proteins / co-transport	3 max
	(e)	<i>if candidates use 'wall' they mean the cells lining the collecting duct if they refer to wall when they mean membrane – reject relevant marking point</i>	
		1 <i>idea of change in permeability to water due to ADH ; to produce a high concentration of urine</i> 2 <u>membranes</u> become permeable ; 3 water moves by <u>osmosis</u> ; 4 down a water potential gradient ; A high to low water potential 5 water moves, out of collecting duct / into blood / into medullary tissue / into tissue fluid ; 6 channel proteins / aquaporins ; R 'water channels' 7 ref to, movement / fusion, of vesicles ; R in context of wall <i>to produce a low concentration of urine</i> 8 <u>membranes</u> become impermeable (to water) ; 9 water remains in urine ; 10 diffusion of, urea / Cl ⁻ / Na ⁺ ; 11 lowers water potential in medullary tissue ;	4 max
			[Total: 16]

Grade Thresholds

Advanced GCE Biology (Aggregation Code 3881 7881)
June 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
2801	Raw	60	45	39	33	28	23	0
	UMS	90	72	63	54	45	36	0
2802	Raw	60	47	43	39	35	31	0
	UMS	90	72	63	54	45	36	0
2803A	Raw	120	97	87	77	67	57	0
	UMS	120	96	84	72	60	48	0
2803B	Raw	120	95	85	75	65	55	0
	UMS	120	96	84	72	60	48	0
2803C	Raw	120	94	84	74	65	56	0
	UMS	120	96	84	72	60	48	0
2804	Raw	90	67	60	53	46	40	0
	UMS	90	72	63	54	45	36	0
2805A	Raw	90	63	55	48	41	34	0
	UMS	90	72	63	54	45	36	0
2805B	Raw	90	58	51	44	37	30	0
	UMS	90	72	63	54	45	36	0
2805C	Raw	90	64	57	51	45	39	0
	UMS	90	72	63	54	45	36	0
2805D	Raw	90	60	54	48	42	36	0
	UMS	90	72	63	54	45	36	0
2805E	Raw	90	62	55	48	41	34	0
	UMS	90	72	63	54	45	36	0
2806A	Raw	120	89	81	73	65	57	0
	UMS	120	96	84	72	60	48	0
2806B	Raw	120	89	80	71	63	55	0
	UMS	120	96	84	72	60	48	0
2806C	Raw	120	86	77	68	60	52	0
	UMS	120	96	84	72	60	48	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3881	300	240	210	180	150	120	0
7881	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3881	16.6	34.0	53.1	70.9	85.4	100	19941
7881	25.8	48.3	69.0	85.8	96.7	100	16210

36151 candidates aggregated this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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