

Biology

Advanced GCE **A2 7881**

Advanced Subsidiary GCE **AS 3881**

Mark Schemes for the Units

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Advanced Subsidiary GCE Biology (3881)

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2804 Central concepts

Question			Expected Answers	Marks
1	(a)	(i)	P glycolysis ; Q Krebs cycle / TCA cycle ;	2
		(ii)	cytoplasm / cytosol ;	1
	(b)		removal of hydrogen (ions) ; A H R H ₂ from, pyruvate / pyruvic acid ; to NAD ; A forming red NAD	3
	(c)		removal of, carbon dioxide / carboxyl group ; R removal of carbon	1
	(d)	(i)	type of respiratory substrate ; correct value for relevant substrate ; aerobic / anaerobic / mixture ;	max 2
		(ii)	<i>seeds soaked in water</i> little oxygen available/anaerobic conditions ; mixture of anaerobic and aerobic respiration ; R anaerobic only <i>seeds after 12 hours in soil</i> more oxygen available ; <i>comparative to first section</i> more aerobic / less anaerobic respiration ; <i>comparative to first section</i> mixture of, substrates / named substrates ; <i>seedlings after 21 days</i> leaves have emerged ; photosynthesis ; A description of photosynthesis respiring, carbohydrate / glucose ; aerobic respiration ;	max 6
				[Total: 15]

Question			Expected Answers	Marks
2	(a)	(i)	eukaryotic ; nucleus / membrane bound organelles ; A named organelle unicellular or groups of similar cells ;	max 2
		(ii)	chloroplasts close to external medium ; short diffusion path for carbon dioxide ; effect of changing carbon dioxide concentration immediate ; easy to extract, intermediates / RuBP / GP ;	max 1
		(iii)	Calvin (cycle) ;	1
		(iv)	stroma ;	1
	(b)	(i)	no change in GP and RuBP when reduced from 3% to 1% ; GP stays at 2.05 (a.u.) and RuBP at 0.95 (a.u.) ; A 2.05 – 2.08 (a.u.), 0.95 – 0.98 (a.u.) GP decreases and RuBP increases when reduced from 1% to 0.03% ; reaches plateau at <u>450</u> (secs) ; <i>Award for either GP or RuBP</i> RuBP peaks, after 385 (secs) / at 1.65 (a.u.) ; A 370-390 (secs) , 1.65 – 1.70 (a.u.) RuBP declines to 0.65 (a.u.) / GP declines to 0.2 (a.u.) ; A 0.65 – 0.68 (a.u.) <i>units not required for any marking points</i>	max 3
		(ii)	RuBP, is carbon dioxide acceptor / fixes carbon dioxide ; ref to Rubisco ; less RuBP used / RuBP builds up ; GP converted to TP ; RuBP, regenerated / AW ; from TP ;	max 4
	(c)		increased rate of photosynthesis ; higher light <u>intensity</u> ; longer days ; warmer / increased temperature ; increased rate of photosynthetic enzymes / anabolic enzymes ; more minerals in water ; due to, increased rate of decomposition / leaching from agricultural land ; increased rate of reproduction ; small primary consumer population ;	max 3
				[Total: 15]

Question		Expected Answers		Marks
3	(a)	<p><i>crossing over</i> (equivalent portions) of homologous chromosomes / (non sister) chromatids ; are exchanged / AW ; new combinations of <u>alleles</u> ; during prophase 1 ; at chiasma(ta) ;</p> <p><i>independent assortment of homologous chromosomes</i> bivalents / pairs of (homologous) chromosomes ; line up on, equator ; during metaphase 1 ; each pair lines up independently of others / randomly ; results in gametes that are genetically unique / AW ;</p>		max 6
	(b)	<p><i>artificial selection</i></p> <p>selection pressure by humans</p> <p>genetic diversity lowered</p> <p>inbreeding common ;</p> <p>loss of vigour ;</p> <p>proportion of heterozygotes in population is reduced</p> <p>genetic isolation mechanisms do not operate</p> <p>(usually) faster than natural selection</p> <p>selected feature not always to organism's advantage ;</p> <p><i>ignore ethical and economic differences</i></p>	<p><i>natural selection</i></p> <p>environmental selection pressures ;</p> <p>genetic diversity remains high ;</p> <p>outbreeding common ;</p> <p>increased vigour ;</p> <p>proportion of heterozygotes in population remains high ;</p> <p>genetic isolation mechanisms operate ;</p> <p>(usually) slower than artificial selection ;</p> <p>selected feature always to organism's advantage ;</p>	max 3
	(c) (i)	hhC ^R C ^W ;		1
	(ii)	<p>Parental genotypes: hhC^RC^W HhC^WC^W ; <i>apply ecf if hornless genotype is HH</i></p> <p>Gametes: hC^R hC^W HC^W hC^W ;</p> <p>Offspring genotypes: Hh C^RC^W, hh C^RC^W, HhC^WC^W, hhC^WC^W ;</p> <p>Offspring phenotypes: hornless roan, horned roan, hornless white, horned white ;</p> <p>Phenotypic ratio: 1 1 1 1 ;</p>		5
[Total: 15]				

Question			Expected Answers	Marks
4	(a)	(i)	<p><i>protein</i> too large ; to be, filtrated / AW ; unable to pass through <u>basement membrane</u> ;</p> <p><i>glucose</i> enters filtrate ; (re)absorbed ; in PCT ;</p> <p>A RMM greater than 69000</p>	max 4
		(ii)	<p>amount of urea remains constant ; water (re)absorbed from filtrate ; by osmosis ;</p>	max 2
	(b)		<p>125 x 60 x 24 ; <i>for working mark</i></p> <p>180 ;; 2 marks awarded for correct answer without any working</p>	2
	(c)	M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12 M13 M14 A15 A16 A17 A18 A19	<p>facilitated diffusion ; using protein carrier ; (linked to M1) cotransport using <u>Na ion gradient</u> ; mineral ions / glucose / amino acids ;</p> <p>active transport / AW ; Na ions out (of epithelial cells) ; <u>Na⁺/K⁺</u> pump ; sets up Na ion gradient ;</p> <p>osmosis ; down water potential gradient ;</p> <p>endocytosis / pinocytosis ; proteins ;</p> <p>diffusion ; urea ;</p> <p><i>max 6 on mechanism section</i></p> <p>microvilli ; many mitochondria ; tight junctions ; folded basal membrane ; many / AW, protein pumps ;</p>	max 8
			<p>QWC - clear, well organised answer using at least 3 of the specialist terms (shown in bold) in correct context ;</p>	1
				[Total: 17]

Question			Expected Answers	Marks
5	(a)	1	identify <u>species</u> present ;	
		2	use of keys ;	
		3	from lower shore to upper shore ;	
		4	use, tape / string, to mark out line ;	
		5	carry out <u>transect</u> ;	
		6	interrupted / continuous ;	
		7	(frame) <u>quadrat</u> ;	
		8	ACFOR scale ;	
		9	estimate percentage cover ;	
		10	animals- number per unit area ;	
		11	ref to calculating species density ;	
		12	ref to calculating species frequency ;	
		13	repeat for reliability ;	
		14	suitable graphical representation e.g. kite diagrams ;	
				max 7
			QWC- legible text with accurate spelling, punctuation and grammar.	1
	(b)	(i)	<i>Fucus vesiculosus</i> ; <i>Fucus serratus</i> ; <i>Patella vulgata</i> ;	max 2
		(ii)	<i>Patella vulgata</i> ;	1
	(c)	(i)	<i>Fucus vesiculosus</i> and <i>Fucus serratus</i> ;	1
		(ii)	light ; space ; carbon dioxide ;	max 2
	(d)		species / community composition, does not change / no seres ; ora with time ;	max 2
			species do not change physical environment ; ora	
				[Total: 16]

Question			Expected Answers	Marks
6	(a)	(i)	insulin ;	1
		(ii)	Islets of Langerhans ;	1
		(iii)	change in shape / AW ; A acquire different carbohydrate chain	1
	(b)		activates phosphorylase enzyme ; converts glycogen to glucose / glycogenolysis ; amino acids, glycerol to glucose / gluconeogenesis ; (consequently) blood glucose rises ;	max 3
	(c)	(i)	rises ; 5.0 to 14.0 mmol dm ⁻³ ; rises by 3.0 mmol dm ⁻³ for first 30 minutes ; A steeper rise in first 30 mins constant rise of 2.0 mmol dm ⁻³ for each further 30 minute period ;	max 3
		(ii)	absorption into blood ; (increased blood glucose) detected by pancreas / b cells ; secretion of insulin ; bind to receptors on cell <u>membranes</u> ; increased uptake of glucose / AW ; rate of respiration increases ; conversion to glycogen ; conversion to lipid ; lower levels in blood ; explanation for rise in final 30 min ; e.g. glucagon secretion / less insulin / negative feedback	max 3
				[Total: 12]

2805/01 Growth, Development and Reproduction

Question			Expected Answers	Marks
1	(a)	(i)	X blood space / mother's blood / lacunae / sinus ; R blood unqualified Y chorionic villi / chorion / villi / trophoblast ; Z <u>umbilical cord</u> ; A umbilical "chord"	3
		(ii)	away from placenta ; A correct labelling on Fig. if not an arrow	1
		(iii)	(umbilical vein has) more (oxygen) / ora ;	1
	(b)	(i)	a collection of cells ; Ignore similar / different specialised / differentiated ; working together / to perform a particular function ;	2
		(ii)	<i>mother</i> (walls of) blood spaces / lacunae / blood sinus / mother's blood / endometrium ; 1 max <i>embryo</i> chorion / chorionic villi / epithelial cells / blood vessels ; 1 max A any correct structure in both sections	2 max
	(c)		the mother's blood is at a high enough pressure, to damage the fetus / AW ; to prevent the immune response / separate maternal and foetal circulations ; as it has a different genotype / AW ; to stop, (most) bacteria / (some) viruses, from crossing the placenta / AW ;	2 max
	(d)	(i)	<i>for placenta:</i> more, cell layers / named (for oxygen to pass through) ; smaller surface area ; blood flow slower / ref to maternal blood sinus ; ref. to less steep diffusion gradient / AW ; AVP ; ; e.g. lower metabolic rate / AW, towards the end of gestation e.g. calculation using figures from table ACCEPT ora for all marking points with reference to alveoli	3 max
		(ii)	<i>fetal haemoglobin:</i> has a <u>higher</u> affinity for oxygen (than maternal haemoglobin) / AW ; will combine with oxygen at oxygen tensions / pp oxygen, where maternal Hb would dissociate / AW ; ref. to gamma chain ; placental membranes / named, very thin / large surface area ; oxygen concentration of fetal blood low ; AVP ; ref oxygen diffusion gradient	3 max
				[Total: 17]

Question			Expected Answers	Marks
2	(a)	1	(<i>S. cernua</i> has low population density therefore) cross-pollination less likely ;	7 max
		2	(few seeds produced therefore) less energy wasted producing, gametes / seeds / flowers ;	
		3	bulbils, are produced asexually / by vegetative propagation ;	
		4	<u>genetically</u> identical / same <u>genotype</u> , as parent ; A clone	
		5	advantageous, characteristics / genotype, maintained / AW ;	
		6	(bulbils are an) advantage if there is no, pollinator / named pollinator ;	
		7	plant will colonise / spread / reproduce, quickly ;	
		8	(bulbils) can survive independently / already, have roots and leaves ;	
		9	(bulbils) have, leaves , for photosynthesis / roots, for water / mineral uptake ;	
		10	competes well with other plants ;	
		11	reproduction is, guaranteed / more reliable ;	
		12	<u>sexual</u> reproduction, also an option / AW ;	
		13	sexual reproduction, increases genetic variation ;	
		14	AVP ; e.g. self-pollination / suitable advantage of seed production	
			QWC – legible text with accurate spelling, punctuation and grammar ;	1
			Candidates should have no more than three different spelling errors. Sentences should be accurately punctuated according to spoken English and text should be legible.	
	(b)		<i>max 4 if no ref to asexual reproduction</i> if environment changes / example of environmental change ; (population) has limited ability to adapt ; by natural selection ; <i>because:</i> less genetic variation ; <i>do not credit</i> no genetic variation no meiosis / mitosis only ; no crossing over ; no, independent / random, assortment ; no opportunity for expression of (advantageous) recessive alleles ; limited gene pool ; correct ref to outbreeding / inbreeding ; no hybrid vigour ; decreased heterozygosity / increased homozygosity / increased chance of recessive alleles being expressed ; AVP ; e.g. overcrowding may exhaust resources / less chance of dispersal / seeds can survive periods of harsh environmental conditions	5 max
	(c)	(i)	can, divide / undergo mitosis ; totipotent / have the potential to become any / all cell types ; A omnipotent unspecialised / undifferentiated ; large nuclear : cytoplasmic ratio / AW ; AVP ; e.g. thin / flexible, cell walls	2 max

Question			Expected Answers	Marks
		(ii)	(meristematic cells) divide, by <u>mitosis</u> ; enlarge / elongate, by absorbing water (by osmosis) ; cells specialise / become adapted for a particular function ; ref. to, gene switch / some genes switched on / off ; synthesise new, materials / structure / named ; <u>differentiate</u> / <u>differentiation</u> ; AVP ; e.g. ref. to three zones / ref. to PGR's	3 max
				[Total: 18]

Question			Expected Answers	Marks
3	(a)	(i)	larynx becomes larger / voice deepens / facial hair (grows) / pubic hair (grows) / body becomes more muscular / genitals / named, enlarge ; R grow / spermatogenesis begins	[1]
		(ii)	<pre> graph TD Hypo[hypothalamus] --> GnRH[GnRH] GnRH --> AP[anterior pituitary] AP --> ICSH[ICSH/LH] ICSH --> Leydig[Leydig / interstitial, cells] Leydig --> Testo[(testosterone)] Testo -.-> negative feedback Hypo Testo -.-> negative feedback AP </pre> <p>key: - - - - - ► = negative feedback / inhibition ; A annotation on diagram</p>	5 max
		(iii)	steroids are, lipid / fat, soluble ; are derived from cholesterol ; (cross the cell membrane) by (simple) diffusion ; R if in context of small molecule ref. to hydrophobic region / non polar ;	2 max
	(b)	(i)	A ora throughout (vasodilation) reduces blood pressure ; reduces damage to the, tunica intima / wall of arteries ; reduces risk of, fatty deposits / plaques / atheroma ; increases blood flow/less resistance to blood flow / AW ; reduces risk of, clots / thrombus ; ref. to reduced risk of, arteriosclerosis / loss of elasticity ;	2 max
		(ii)	A ora throughout testosterone prevents, transmission (of nerve impulse) across synapse / AW ; calcium ion / Ca^{2+} , channels are found in, presynaptic membranes / synaptic knob ; vesicles would not move to pre-synaptic membrane ; no, neurotransmitter / acetylcholine, released ; no depolarisation of post-synaptic membrane ; no stimulation of muscle in arteriole / action potential does not reach muscle ;	3 max

Question			Expected Answers	Marks
		(iii)	testosterone disrupts negative feedback / AW ; (this would) reduce natural testosterone production / levels ; produce a feminising effect / reduce spermatogenesis / reduced sperm count ; may cause excessive masculinisation / AW ; may increase, sex drive / aggression ;	2 max
				[Total: 15]

Question		Expected Answers	Marks
5	(a)	<p><i>fetus:</i> initially / from 20 weeks to 26 / 28 weeks, (fetal) mass increases, gradually / AW ; from, 26 / 28, weeks (onwards) mass increases, rapidly / AW ;</p> <p><i>placenta:</i> gradual / steady, increase (in mass) throughout / AW ; 36 - 40 weeks (mass) plateaus / AW ;</p> <p>paired figs. in support for either fetus or placenta ;</p>	3 max
	(b)	<p>1 relative growth is, change in mass / growth (in a given time), compared with starting mass / <u>growth in a given time / change in parameter / absolute growth rate</u> mass / parameter at beginning (of time period) / percentage increase in mass in a given time ;</p> <p>2 shows efficiency of growth / easy to see / compare when growth is most rapid / AW ;</p> <p>3 example using figures from graph to illustrate ;</p>	2 max
	(c)	<p>1 oxytocin ;</p> <p>2 produced in hypothalamus ;</p> <p>3 released by posterior pituitary (gland) ;</p> <p>4 uterus becomes more sensitive to oxytocin ;</p> <p>5 because progesterone levels fall / AW ;</p> <p>6 oxytocin makes uterine <u>muscle</u> contract ;</p> <p>7 positive feedback ;</p> <p>8 oestrogen and progesterone control breast development / oestrogen, stimulates development of (milk) ducts / progesterone, stimulates development of glands ;</p> <p>9 human placental lactogen / HPL, <i>qualified</i> ;</p> <p>10 prolactin releasing factor / PRF ;</p> <p>11 from hypothalamus ;</p> <p>12 prolactin, <i>qualified</i> ;</p> <p>13 from anterior pituitary ;</p> <p>14 as level of oestrogen <u>and</u> progesterone, decrease / no longer inhibit prolactin release ;</p> <p>15 (prolactin) stimulates milk production ;</p> <p>16 oxytocin stimulate release / ejection / flow, of milk ;</p> <p>17 suckling increases secretion of prolactin releasing factor (from hypothalamus) ;</p> <p>18 AVP; e.g. suckling sets up a nervous reflex / positive feedback ref. prostaglandins stimulate uterine contractions ref. relaxin</p>	7 max
		QWC - clear, well organised answer using specialist terms in correct context ;	1
		At least 3 of the terms shown in bold	
			[Total: 13]

Question			Expected Answers	Marks
6	(a)	(i)	gibberellins are growth promoters / hormones / PGR's ; production stimulated by , absorption of water / imbibition ; (gibberellin) stimulates / causes, synthesis of (α) amylase ; in aleurone layer ; amylase <u>hydrolyses</u> starch ; produces maltose ; provides glucose for, respiration / ATP production ; (ATP / energy) for growth / protein synthesis / AW ; AVP ;; e.g. starch from the endosperm / gibberellin produced by the embryo ref. gene switch / gibberellin stimulates transcription of mRNA	5 max
		(ii)	prevents germination during <u>short</u> periods of favourable conditions ; ensures germination when conditions are favourable ; ora allows the <u>seed</u> to survive unfavourable conditions ; allows time for dispersal ; prevents pre-germination / germination when in the fruit ; spreads the germination time in different species ; synchronises germination in same species ; to increase chance of (cross) pollination / AW ; enables germination after a specific / named event ; e.g. fire / flood	3 max
	(b)	(i)	<i>Credit reasonable discussion on the following:</i> seedlings are grown in identical conditions / gibberellin is the only variable ; example of condition controlled ; e.g. <i>light / temperature / number in each batch</i> seedlings are pure bred/same genotype, to reduce genetic variation ; batch 8 is not sprayed / use of a control ; batch size ; AVP ; e.g. use of repeats e.g. duration of experiment	3 max
		(ii)	<u>homozygous</u> ; both parents dwarf / homozygous ; produced by selfing / self pollination ; (offspring) <u>breed true</u> / produce known characteristic / AW ; (offspring) have known genotype ; any observed variation in seedlings, will not be due to genotype / will be due to gibberellin ; produce a standard / predictable, response to gibberellin ;	3 max
		(iii)	gene controls the production of gibberellin ; no / reduced, gibberellin production ; dwarf peas must be homozygous (recessive) ; gene mutation ; AVP ; e.g. inbreeding e.g. no cell elongation	2 max
				[Total: 16]

2805/02 Applications of Genetics

Question			Expected Answers	Marks
1	(a)	(i)	AaBbCC orange (flowers) ; aaBbcc red (flowers) ; aabbcc white (flowers) ;	3
	(b)	(i)	easier to select the orange colour ; flower can only be orange or white ; no other, (active) enzyme / pigment, produced / present ; A red and purple not produced / enzymes B and C not present to, alter / modify / interfere with, orange colour ;	2 max
		(ii)	accept two of the following selective breeding requires, gene / allele, to be present in, population / species ; selective breeding would require (rare) mutant <i>Petunia</i> ; or breeding with another species with orange flowers ; genetic engineering, much quicker / can be achieved in one generation ; adds only required gene to <i>Petunia</i> (genome) ; AVP ; e.g. does not alter, viability / other desirable trait e.g. ref. to background genes/no backcrossing required R 'easier' and 'costs'	2 max
	(c)		<i>continuous v. discontinuous variation</i> 1 no discrete classes v. discrete classes / AW ; 2 vary between limits v. no intermediates ; 3 quantitative v. qualitative ; 4 plotted as normal distribution curve v. bar chart ; A ref to descriptive statistics ; 6 large v. small / no, environmental effect ; AVP ; e.g. use of, continuous / discontinuous, example max 5 7 3 / >3 / several, genes v. one/few gene(s) ; 8 <u>polygenes</u> (v. not so) ; 9 many alleles v. few(er) alleles ; 10 different alleles have small v. large effects ; 11 additive effects (v. different effects) ; 12 single loci have small effects v. big effects ; 13 AVP ; e.g. further detail <i>re Petunia</i> genotypes / ref to codominance	7 max
			QWC – legible text with accurate spelling, punctuation and grammar	1
				[Total: 15]

Question		Expected Answers		Marks
5	(a)	<p>1 recessive (allele) ;</p> <p>2 autosomal/not sex-linked ;</p> <p>3 on chromosome 7 ;</p> <p>4 homozygote recessives show disease ; A double recessive</p> <p>5 homozygote dominants and heterozygotes are unaffected ;</p> <p>6 heterozygotes are carriers ;</p> <p>7 between 1 in 20 and 1 in 25 (in white races) ;</p> <p>8 two carrier parents have a 1 in 4 chance of producing an offspring with CF ; A alternative cross</p> <p>9 chance is the same at each conception / AW ;</p> <p>10 large number of / more than 400, (different) mutations ;</p> <p>11 one causes, most/c. 70%, of cases ;</p> <p>12 has deletion of one DNA triplet ;</p> <p>13 so results in loss of one amino acid ;</p> <p>14 AVP ; e.g. codes for cystic fibrosis transmembrane conductance regulator (CFTR)</p> <p>protein transports chloride ions across cell surface</p> <p>membrane mutations produce qualitative and quantitative changes in CFTR function</p> <p>individual may have two different mutations</p> <p>1 in 2500 live births</p> <p>QWC – clear, well-organised answer using at least 3 of the specialist terms (shown in bold) in correct context ;</p>		<p>7 max</p> <p>1</p>
	(b)	(i)	<p>1 mutant allele reduces uptake of all three strains ; ora</p> <p>2 but not to 0 / AW ;</p> <p>3 large differences because log scale ;</p> <p>4 use of comparative figures <i>re</i> effect of different alleles on uptake ;</p> <p>5 use of comparative figures <i>re</i> uptake of different strains ;</p>	4 max
		(ii)	<p>ref to CFTR / transmembrane protein / ion channel ;</p> <p>membrane less easily penetrated than normal by bacteria ;</p> <p>ref to phagocytosis of bacteria by cells ;</p> <p>ability to bind to membrane altered / may bind to normal CFTR ;</p> <p>altered ion transport hinders bacterial uptake ;</p> <p>sticky mucus hinders bacterial, movement / uptake ;</p>	3 max
				[Total: 15]

Question		Expected Answers	Marks
6	(a)	<p>1 HLA genes code for, tissue type / self v. not self ;</p> <p>2 6 / 4, genes ; accept - A, B, C, DP, DQ, DR (A, B, C, D)</p> <p>3 each with many alleles ;</p> <p>4 cell surface glycoproteins ;</p> <p>5 antigens ;</p> <p>6 rejection if not matched ; ora</p> <p>7 <u>immune response</u> ;</p> <p>8 detail of immune response ; e.g. role of, antibody / B cell / T cell</p> <p>9 some genes / B / DR, more important than others in rejection ;</p> <p>10 match, more likely within family / rare outside family ;</p> <p>11 (because) genes, closely linked/inherited as haplotype / inherited as supergene ;</p> <p>12 crossing over is rare ;</p>	5 max
	(b)	<p>dominant allele, added to existing genotype / is expressed ;</p> <p>recessive inactive so effect of dominant seen ;</p> <p>mutant dominant would have to be, inactivated / selectively removed ;</p> <p>(so) not, easy / feasible, as yet ;</p> <p>may become possible through, antisense technology / RNAi (interference RNA) ;</p>	3 max
	(c)	<p>A less haemoglobin with 2 human β-globin chains in normal mice /ora;</p> <p>1 normal mouse has two normal mouse β-globin alleles ;</p> <p>2 with, switch / promoter ;</p> <p>3 in usual place on chromosome ;</p> <p>4 much, easier / quicker, to express / transcribe, than added gene ;</p> <p>5 heterozygous mouse has only one active, allele / gene ; ora</p> <p>6 added gene may be anywhere in chromosomes ;</p> <p>7 by chance in different places in two types of mice ;</p> <p>8 may be within, unused / inactive / junk, DNA ;</p>	3 max
	(d)	<p><i>named benefit to max 2 (accept in context of germ line therapy)</i></p> <p>therapy may be a cure so medication not needed ;</p> <p>therapy is, effective / successful, treatment of genetic condition ;</p> <p>therapy may be more effective than medication ;</p> <p>many genetic conditions are difficult to treat in other ways ;</p> <p>quality of life / life expectancy, improved ;</p> <p>AVP ; e.g. may be development of one of the above (possible) benefits</p> <p>AVP ;</p> <p><i>named hazard to max 2</i></p> <p>DNA may have unforeseen effects in target cells ;</p> <p>switching, on / off, other genes ;</p> <p>affected cells may not be specifically targeted ;</p> <p>DNA, entering other (non-target) cells may have unforeseen effects ;</p> <p>DNA, may enter germ line cells and be passed to offspring ;</p> <p>viral vector may induce immune response ;</p> <p>resulting in inflammation ;</p> <p>AVP ; <i>may be development of one of the above hazards</i></p> <p>AVP ;</p> <p>R low success rate / 'playing God'</p>	<p>2 max</p> <p>2 max</p>
			[Total: 15]

2805/03 Environmental Biology

Question		Expected Answers	Marks
1	(a)	1.5 (million tonnes) ;; <i>1 calculation mark if answer not expressed to 1 d.p or if answer wrong but calculation shows $6.2/100 \times 24$</i>	2
	(b)	(cellulose) found in plant <u>cell walls</u> / AW ;	1
	(c)	chlorine is toxic and might lead to death (of organisms) ; (decrease level of photosynthesis) by damage to, pigments / light dependent or independent reaction ; affect osmotic potential / ref to water potential changes / ref to flaccid / plasmolysed cells ; AVP ; e.g. may affect active transport inhibits enzymes affects cell division / mitosis	max 2
	(d)	(door to door) collections ; separate / recycling, bins ; payments ; fines ; increase awareness / education ; AVP ; e.g. competitions / advertising	max 3
	(e)	1 coarse / AW, filter removes large items / AW ; 2 sewage broken up by macerator / AW ; 3 sewage settles in tanks ; 4 liquid filtered / drained off ; 5 bacteria / protozoa added ; 6 detail of microorganism role in decomposition / breakdown ; 7 liquid run off along trickling / filter, bed / AW ; 8 settles over time ; 9 to reduce / AW, BOD ; 10 activated sludge ; 11 detail of activated sludge e.g. aeration / lowering nitrate / phosphate ; 12 ref. to uv (light) ; 13 ref. to other processes such as chlorination / ozone ; 14 AVP ; e.g. further detail of bacterial/protozoan role 15 AVP ; e.g. ref reed beds	max 8
		QWC – clear, well organised answer using at least 3 of the specialist terms (shown in bold) in correct context ;	1
			[Total: 17]

Question		Expected Answers	Marks
2	(a)	(large) human population ; effect of population ; e.g. threat of development / houses and services such as roads many conservation areas to manage ; large numbers of visitors possibly damaging National Park areas ; increased development of amenities for visitors ;	max 3
	(b)	data is of limited use / AW ; (because) no data for size of National Parks ; no specific information about conservation areas ; example of missing information ; e.g. designation type not specified AVP ; e.g. no detail of, visitor activities / means of transport no information on yearly patterns / variation within year for tourism	max 2
	(c)	<i>accept ora throughout for intensive farming</i> <i>extensive</i> less fertilizer added ; less pesticide ; lower yields ; larger area of land needed ; lower costs (per unit area) ; lower stocking levels ; lower productivity ; less use of (large heavy) machinery ; tends to use more labour / AW ; AVP ; e.g. ref to quality of grazing	max 5
	(d)	all land activities monitored ; (government) can stop development ; A in context of legal powers / planning consent money can be made available for protection ; SSSIs have conditions (of important features) monitored ; management agreement with landowners ; (government agencies) list damaging activities ; AVP ;	max 3
	(e)	description of pollarding ; description of coppicing ; description of selective / strip, felling ; AVP ; e.g. use of suitable species for local conditions / replanting	max 2
			[Total: 15]

Question		Expected Answers	Marks
3	(a)	higher the TBT level the higher the TI / shell thickness ; ref. to anomalies within data ; comparative data quote ;	max 2
	(b)	t-test ; further detail ; e.g. null hypothesis / ref to appropriate degrees of freedom / 0.05 significance level if chi squared given ecf for detail as above - <i>max 1</i> or correlation coefficient ; e.g. Spearman's rank further detail ;	max 2
	(c)	TBT is persistent / slow to degrade / AW ; TBT likely to be fat soluble ; (so) not excreted ; producers and primary consumers only have small level of TBT due to, size / longevity, of organism ; idea of secondary and tertiary consumers consuming many organisms ; AVP ;	max 3
	(d)	reproductive success ; size of mussel ; sex ratio / male to female numbers ; population sizes ; population dynamics ; e.g. number of adults to juveniles shell colour ; endocrine / hormonal level ; enzymic / metabolic / respiratory rate / AW ; life span ; mutation rate ; AVP ;	max 3

Question		Expected Answers	Marks
	(e)	<p><i>air pollution</i></p> <p>named example ; e.g. lichen sensitive to named pollutant ; e.g. sulphur dioxide/acid rain presence or absence indicates pollution ; ref. to tolerance of certain species ; idea of zones of tolerance ; sample at intervals away from pollution source ; further detail of sampling ; repeat to obtain mean ; use of identification key ; AVP ;</p> <p><i>Water pollution</i></p> <p>named example ; e.g. stone fly nymphs / may fly nymphs sensitive to low water oxygen level ; presence / absence indicates pollution ; ref. to tolerance of certain species ; use of kick sample ; further detail of sampling ; repeat to obtain mean ; use of identification key ; AVP ;</p>	max 5
			[Total: 15]

Question		Expected Answers	Marks
4	(a)	<p>require different conditions / AW ;</p> <p>control agents might work / feed on each other and not pest / AW ;</p> <p>idea of competition ;</p> <p>idea of limited resources ;</p> <p>further detail ; e.g. <i>M. calliginosus</i> eats larvae and so other two would not be able to survive</p> <p>AVP ; e.g. ref. to cost and management of releasing all three at same time</p>	max 4
	(b)	<p>parasitic wasps might be slower to work / AW ;</p> <p>parasitic wasp eggs might take a while to hatch ;</p> <p>parasitic wasps must fly and locate prey so therefore slower to act / AW ;</p> <p>AVP ;</p>	max 2
	(c)	<p>environmental benefits / AW ;</p> <p>(idea of) bioaccumulation ;</p> <p>pesticides might kill biological control agent ;</p> <p>pesticides might kill beneficial insects / non target species ;</p> <p>pesticides (might kill pest) and remove food for biological control agent / disrupt food chains ;</p> <p>idea of pest resistance (over time) ; R immunity</p> <p>health benefits ;</p> <p>AVP ; e.g. to demonstrate good practice</p>	max 4
	(d)	<p>(weeks 1 and 2) no difference in aphid population size ;</p> <p>presence of natural predators reduces growth of aphid population ; ora</p> <p><i>presence of natural predators</i></p> <p>aphid population reaches plateau ;</p> <p>relevant data quote ;</p> <p><i>absence of natural predators</i></p> <p>aphid population peaks (and declines) ;</p> <p>relevant data quote ;</p>	max 3
	(e)	<p>ref. to cost ;</p> <p>pressure from agricultural companies ;</p> <p>pressure from supermarkets / no aphids allowed on food / AW ;</p> <p>biocontrol needs to be reintroduced / labour intensive ;</p> <p style="text-align: right;">A ease of application</p> <p>biocontrol slow to act ;</p> <p>lack of knowledge for biocontrol of all pests ;</p> <p>biocontrol cannot be used in large fields ;</p> <p>AVP ;</p>	max 3
			[Total: 16]

Question		Expected Answers	Marks
5	(a)	oxygen needed for, bacteria / microorganisms / roots or rhizome (in rhizosphere) ; <u>aerobic</u> respiration ; detail of respiration ;; e.g. Link reaction/Krebs cycle e.g. idea that oxygen atoms mop up protons AVP ; e.g. ref. to active uptake in plant roots	max 2
	(b)	measure oxygen content of samples ; method ; e.g. oxygen probe / Winkler detail of method ; method of obtaining BOD ; e.g. do at start and end of 5 days at c.20-25 degrees C idea of repeating whole procedure ;	max 3
	(c)	crown die back ; tree and leaf damage / decreased level of photosynthesis ; increased susceptibility to disease ; lack of breeding in birds ; death of fish embryos / adult reproduction affected ; R just 'fish die' effect on homing instinct in salmon ; increase solubility of heavy metal ions / Al ; Al causes increased mucus in gills ; gill permeability to calcium altered ; thinner exoskeletons of crustaceans and molluscs ; erosion of limestone ; AVP ;	max 3
	(d)	<p>1 named pollutant ; e.g. nitrates / phosphates / slurry</p> <p>2 surface run off / leaching into water system ;</p> <p><i>description</i></p> <p>3 eutrophication ;</p> <p>4 promotes growth of algae / plants ; A algal bloom</p> <p>5 prevents light reaching (sub) aquatic organisms / AW ;</p> <p>6 idea of stopping photosynthesis ;</p> <p>7 algae and plants die ;</p> <p>8 decomposition by <u>aerobic</u> bacteria ;</p> <p>9 increased, biological oxygen demand / BOD ;</p> <p>10 oxygen from water used up ;</p> <p style="text-align: right;"><i>max 4 for description</i></p> <p><i>consequences</i></p> <p>11 water becomes <u>anoxic</u> ;</p> <p>12 leading to death of fish and aquatic organisms ;</p> <p>13 idea that some algae may be toxic / release toxic compounds ;</p> <p>14 AVP ; e.g. correct ref. to anaerobic bacteria</p> <p>15 AVP ;</p>	max 7
		QWC – legible text with accurate spelling, punctuation and grammar;	1
			[Total: 16]

Question			Expected Answers	Marks
6	(a)		melting will increase release of CO ₂ / methane ; (idea that) this will lead to increase in global warming ; (idea that) this leads to more melting of permafrost and the cycle continues / AW ; ref. to fact that methane has more warming potential than CO ₂ ; links to rising sea levels / flooding ; ref. to changing climatic conditions globally ; AVP ;	max 3
	(b)		Rio Earth Summit / Kyoto / Copenhagen, meetings ; idea that emissions cut to earlier levels ; ref. to carbon trading ; detail of measures to offset emissions ; e.g. tree planting targets for renewable energy ; detail of renewable / alternative energy sources ; (idea of) energy saving measures ; AVP ;	max 3
	(c)	(i)	seasonal fluctuations ; (due to) differences in productivity / AW ; ref. to photosynthesis and CO ₂ absorbed ; AVP ; e.g. physical explanation linked to oceanic changes	max 2
		(ii)	line follows similar trend to CO ₂ but drawn underneath ;	1
		(iii)	increase due to melting permafrost ; increase due to rise in intensive agriculture ; (idea of) more cows / pigs / rice cultivation ; increase due to more human waste / land fill ; AVP ; ref. to methane being globally, in ppb not ppm / much lower	2
				[Total: 11]

2805/04 Microbiology and Biotechnology

Question		Expected Answers	Marks
1	(a)	<p>allow any two of bacteria / fungi / protoctist where relevant</p> <p>viruses do not have, cell surface / plasma membranes ; ora</p> <p>only some viruses have DNA as their genetic material / some viruses have <u>RNA</u> as their genetic material / AW ; R all viruses</p> <p>not all fungi, bacteria and protoctists are pathogens ;</p> <p>ora A only some are pathogens</p> <p>relevant comment about use of ATP ;</p> <p>e.g. viruses only indirectly when use host cell machinery</p> <p>A relevant comment about ATP production</p> <p>AVP ; e.g. viruses require host cell for replication, others do not</p>	3 max
	(b)	(i)	
		kingdom phylum order genus species	
		<p>all correct for two marks ;;</p> <p>phylum and species in correct position only, allow one mark</p>	2
		(ii)	
		Prokaryotae / Prokaryote ;	1
		(iii)	
		(DNA) circular / AW ; A ref. to circular plasmids not complexed with (histone) proteins ; A naked DNA no <u>true</u> nucleus / not surrounded by nuclear envelope ; A nuclear membrane	2 max
		(iv)	
		members of Enterobacteriales found in gut (as is <i>Escherichia</i>) / AW ; (<i>Escherichia</i>) is Gram negative / stains red with Gram stain ; ora	1 max
	(c)	(i)	
		Plasmodium causes malaria ; <i>must have both to score</i>	1
		(ii)	
		any relevant example for one mark unicellular (rather than multicellular) ; no vascular tissue / AW ; e.g. undifferentiated	1 max
	(d)		
		unicellular <u>or</u> <u>filamentous</u> / mainly <u>filamentous</u> ; (filamentous) hyphae / (grow as) mycelium ; chitin / mannan and glucan, cell wall ; heterotrophic / saprobiotic / saprotrophic / parasitic ; A not autotrophic / unable to photosynthesise (hyphae) apical growth / growth only at tips ; <u>eukaryote</u> / <u>eukaryotic</u> ; AVP ;	3 max

Question		Expected Answers	Marks
	(e)	<p><i>max 3 if not named</i></p> <p><i>lambda</i> circularisation / AW ; integration / incorporation, into host genome / AW ; (exists as) prophage / provirus ; lysogeny / lysogenic (bacteria) / temperate (phage) / latent (phage) ; A dormant</p> <p>virus replicates as cell replicates ; correctly named host cell e.g. <i>Escherichia coli</i> ; AVP ; e.g. linear DNA with single stranded complementary ends for circularisation, use of , <i>E. coli</i> / host, ligase, use of viral integrase for integration</p> <p><i>HIV</i> RNA to DNA / DNA synthesised / retrovirus ; (linear DNA) integration / incorporation, into host genome / AW ; (exists as) provirus ; latent ; A dormant</p> <p>virus replicates as cell replicates ; correctly named host cell e.g. T-lymphocyte ; AVP ; e.g. reverse transcriptase, integrase, entry into nucleus</p>	4 max
			[Total: 18]

Question			Expected Answers	Marks
2	(a)		<p>all correct for three marks ;;; two marks if 4 stages correct one mark if 2 stages correct</p> <p>description of production stage stage number in yoghurt production</p> <p>milk is heated to 90°C 3</p> <p>cooling to 4.5°C occurs 7</p> <p>incubation occurs at 32°C 6</p> <p>raw milk arrives from the supplier (1)</p> <p>milk is cooled to 45°C 4</p> <p>a sample of raw milk is tested 2</p> <p>the starter culture is added 5</p>	3 max
	(b)	(i)	<p>both populations benefit (from the interaction) / each creates conditions that, favour the other / meet each other's needs / AW ; general reference to causing, population growth / increase in numbers ; <i>Lactobacillus</i> produces peptides for (growth of) <i>Streptococcus</i> ; <i>Streptococcus</i> produces, methanoic acid / CO₂, for (growth of) <i>Lactobacillus</i> ;</p>	3 max
		(ii)	<p>correct reference to, cardiovascular / heart, disease ; A high blood pressure</p>	1
		(iii)	<p>conditions not favourable for spoilage organisms / AW ; A texture ref. products of microbial metabolism / AW ; ref. production of, acids / named acid ; (cause) decreased pH ; AVP ; e.g. no available niches, competition with starter culture bacteria</p>	2 max
				[Total: 9]

Question		Expected Answers	Marks
3	(a)	<i>award marks in either section to max 7</i>	7 max
		1 bacteria / bacterial (endo)spores and / or, fungi / fungal spores, present in the external environment / AW ; R spores	
		2 broth cannot become contaminated spontaneously / no spontaneous generation / AW ;	
		3 broth provides nutrients for (contaminating), organisms / AW, to, grow / replicate ;	
		4 autoclaving, sterilises / kills microorganisms / AW ;	
		5 microorganisms (entering from external atmosphere), trapped / AW, in swan neck (so unable to get to broth) ;	
		6 contents remained clear as no, contamination / microbial growth, occurred or	
		turbid / cloudy, broth indicates, microbial/population growth ;	
		7 growth occurs within three days ;	
		8 tipping contents allowed contact between broth and microorganisms ;	
		9 relevant comment about microscopic examination ; e.g. does allow microorganisms to be seen, confirming no microbes in step 4 ;	
		10 plating out onto agar confirms living, growing microorganisms ;	
		11 AVP ; e.g. further detail of above points	
	(b)	haemocytometry ; A haemocytometer / counting chamber turbidimetry / colorimetry / spectrophotometry ; A colorimeter / turbidity meter / spectrophotometer dilution plating / AW	2 max
	(c)	few / no, microorganisms seen under microscope ; no / poor, (microbial) growth ; max 1 nutrient broth contains components required for growth ora / AW ; named example of nutrient with role ; max 1	2 max
	(d)	flame neck of jar ; remove sample with named equipment ; e.g. inoculating, loop / wire, pipette, syringe ref., sterility / method to ensure sterility of equipment ; open lid of Petri dish, slightly / away from face / AW ; description of sample onto agar surface ; e.g. streak plating / glass spreader (partially) tape / seal ; incubation with appropriate temperature (between 20°C – 30°C) ; appropriate time for incubation (2-4 days) ;	5 max
	(e)	<i>bacteria</i> colonies ; lawn (where colonies merge) ; description of colony ; e.g. circular <i>fungi</i> mycelium / hyphal network / thread-like / AW ; circular mat / AW, increasing in size ; description ; e.g. colour, clear in centre, aerial irregular, convex hyphae visible <i>accept correctly named examples where a comparison is relevant</i>	2 max
			[Total: 18]

Question		Expected Answers	Marks
4	(a)	<p><i>rate too high</i></p> <p>not enough time for growth of fungus to occur ; A little growth of fungus outflow will contain unused nutrients ; ref. effect of some nutrients inhibitory at high concentrations ; cost implications ;</p> <p><i>rate too low</i></p> <p>the fungus remains in the fermenter for longer than necessary ; may reduce growth rate ; build-up of toxic products ; may lead to clumping / AW ; AVP ; eg correct ref to population growth curve/secondary metabolites</p>	3 max
	(b)	<p>to avoid contamination of, culture medium / fermenter contents ; product is for consumption so health risks / AW ; contamination would mean products need to be discarded / AW ;</p> <p>surfaces, smooth / non-porous (for easy cleaning) ; walls / floors / surfaces, disinfected ; A sterilised two doors / air locks (to prevent mixing of fermenter area and external air) ; workers in protective clothing ; A named clothing e.g. gloves and masks AVP ; e.g. stepping onto disinfectant mat before entering area, air filtered <i>max 3</i></p>	4 max
	(c)		
	(i)	200 (minutes) ;	1
	(ii)	400 (flow cycles) ;	1

Question		Expected Answers	Marks
	(d)	allow points from annotated diagram	
	1	Fusarium (<i>graminearum</i>), starter culture / inoculum ; A <i>F. graminearum</i> (but not eligible for QWC)	
	2	any one relevant nutrient with role ; e.g. glucose for, carbon / energy, source ammonia / ammonium phosphate, for nitrogen source, choline for hyphal growth	
	3	any other named nutrient with role or <u>two</u> other named nutrients ;	
	4	temperature 25 - 30°C ;	
	5	pH 6.0 -7.0 ;	
	6	any two features of airlift loop principle ;;	
	7	e.g. bubbles rise so, lift / circulate, culture medium carbon dioxide / waste gases, vented / extracted, at the top denser culture and medium fall flow past inlet of nutrients	
	8	heat exchanger , qualified e.g. to ensure, constant / optimum, temperature ; A remove excess heat	
	9	ref. to sterility ; e.g. sterile / filtered air in, sterile nutrients in, fermenter steam -sterilised	
	10	ref. to (compressed) air with oxygen / aerobic fermentation ;	
	11	nutrients / fresh medium, are added at a constant rate and, harvesting occurs at same (constant) rate / AW ; A volume maintained (with either entry of nutrients or exit of products/waste) max 6	
	12	accept ora for batch for mp 12-15 maintained in rapid growth (phase) for higher productivity ; A log / exponential	
	13	growth rate can be changed by altering rate of entry of nutrients ;	
	14	conditions controlled so quality of product constant ;	
	15	sterilisation of fermenter less frequent so, cost / labour / time, savings ;	
	16	AVP ; e.g. additional detail airlift (loop) fermenter, use a high yield strain of <i>Fusarium</i> , no paddles to avoid damage, other benefit such as smaller fermenter or less space required, details of probes	8 max
		QWC - clear, well organised answer using at least 3 of the specialist terms (shown in bold) in correct context ;	1
			[Total: 18]

Question			Expected Answers	Marks
5	(a)	(i)	<p>mixture / AW, methane and carbon dioxide ; <i>max 1</i></p> <p>other gas(es) named ; e.g. hydrogen sulphide, hydrogen, water produced by <u>anaerobic</u> digestion / AW ;</p> <p>(of) organic material ;</p> <p>combustible / used as a fuel / alternative energy source (to fossil fuels) ;</p>	2 max
		(ii)	<p><i>any two relevant examples</i></p> <p><i>allow use as a fuel once only in (i) or (ii) to candidate's benefit</i></p> <p>product / biogas, can be used as a fuel source ; A examples of use method of dealing with, (organic) waste / AW ;</p> <p>cheaper fuel source ;</p> <p>product (of waste digestion), usable / useful ;</p> <p>provide fuel in areas where shortage ;</p> <p>ref. to health advantages of not having to, dry / burn, manure (flies on drying manure / eye problems with burning) ;</p> <p>slurry in biogas fermenter can be used as fertiliser ;</p> <p>waste product of digestion pathogen-free / AW ;</p>	2 max
	(b)		<p><i>any 3 relevant features qualified</i></p> <p>appropriate material / stainless steel / other named, corrosion proof / some materials inside fermenter corrosive / long lasting / AW ;</p> <p>appropriate material / stainless steel / other named, to, withstand build-up in pressure / restrict explosions / AW ;</p> <p>enclosed / airtight vessel / anaerobic conditions / AW, for, methanogens / named microorganism <i>or</i> microorganisms are (strict) anaerobes / respire, anaerobically / without oxygen ;</p> <p>outlet pipe / AW , to remove biogas / as build-up causes pressure increase / biogas is useful ;</p> <p>method to add organic waste, qualified ; e.g. steady inflow as continued biogas production is required, long narrow pipe to prevent entry oxygen method of stirring allowing, contact of waste with all bacteria/release of biogas</p> <p>method of preventing overheating e.g. shading / underground, to prevent killing microorganisms ;</p> <p>method of heating if too cold as biogas production, will not occur / will be too low ;</p>	3 max
	(c)		<p>volume / mass, of (organic) waste added ;</p> <p>composition of (waste) added ;</p> <p>pH ;</p> <p>AVP ; e.g. volume of oxygen introduced initially (when waste added)</p>	1 max

Question	Expected Answers	Marks
(d)	<p><i>description, explanation, role of microorganisms points for max 8</i> <i>max 6 if only 2 sections covered</i> <i>max 4 if only 1 section covered</i></p> <p><i>description</i></p> <p>1 increasing the temperature, increased the volume of methane produced ; ora</p> <p>2 at temperatures, of 30°C / above 30°C, 7 day retention produces highest volume ; ora</p> <p>3 (at temperatures) at 25°C / above 25°C, 14 day retention produces higher volume than 21 days ;</p> <p>4 at, 15°C / 20°C, 14 day and 21 day retention produces equal volumes ;</p> <p>5 15°C / 20°C, 7 day retention, no methane produced ;</p> <p>6 any correct data quote to support ;</p> <p><i>explanation</i></p> <p>7 (increasing temperature) increased bacterial activity ; ora</p> <p>8 higher temperatures increase rates of reaction ; ora</p> <p>9 ref. to involvement of enzymes ;</p> <p>10 for lower mean volumes for 14/21 days compared to 7 days ;;</p> <p>11 e.g. decrease in pH not optimum balance between bacterial types alters (waste) substrate depleting</p> <p>12 (increasing volume over time) time taken for anaerobic digestion before methane produced ;</p> <p><i>microorganisms</i></p> <p>13 idea of, stages in anaerobic digestion / different microorganism populations ;</p> <p>14 ref. to facultative anaerobes / acetic acid-forming bacteria ;</p> <p>15 digestion of protein to amino acids (to fatty acids) / polysaccharides into simple sugars (then to fatty acids) / fats and oils to fatty acids ;</p> <p>16 methane production from, methanogens / named bacteria ;</p> <p>17 AVP ;; e.g. different volumes of methane could be produced on different days, mean values given, methane produced after 7 days shown by</p> <p>18 14 / 21 days results / AW, shows microorganisms are present ;</p> <p>QWC – legible text with accurate spelling, punctuation and grammar;</p>	<p>8 max</p> <p>1</p>
		[Total: 17]

Question			Expected Answers	Marks
6	(a)	(i)	primary immune response ;	1
		(ii)	hybridoma ;	1
		(iii)	human chorionic gonadotrophin / HCG ;	1
		(iv)	biological recognition layer ;	1
		(v)	gluconic acid ;	1
	(b)	(i)	<p><i>accept alternative correct methods</i></p> <p><i>HGH</i> amino acid sequence identified ; genetic code used ; DNA / gene, synthesised ;</p> <p><i>insulin</i> mRNA extracted ; reverse transcriptase used ; to synthesise, DNA / gene ;</p> <p><i>factor VIII</i> gene identified ; restriction, endonuclease / enzyme used ; (gene) cleaved / cut out ;</p>	2 max
		(ii)	genes code for proteins ;	1
	(c)		<p><i>any two relevant examples</i></p> <p>easier to add gene / AW ; simple nutritional requirements make production, easier / cheaper ; can be cultured in fermenters so can be grown anywhere in the world / AW;</p> <p>pure product produced so reduced chance of, contamination / named ; fast rate of replication so more product produced (per unit time) ; replication allows gene cloning so, more product / more cost effective ; product identical to human, insulin / HGH, so less chance of, side-effects / immune response/allergic reaction ;</p> <p>fewer, ethical / moral / religious problems (than, pig insulin / brains of cadavers) so more acceptable to take treatment ;</p>	2 max
				[Total: 10]

2805/05 Mammalian Physiology and Behaviour

Question			Expected Answers	Marks
1	(a)	(i)	islet of Langerhans / α and β cells ;	1
		(ii)	1. enzymes are, proteases / proteolytic ; 2. named inactive example ; e.g. trypsinogen 3. (if active) would hydrolyse protein ; A digest / breakdown 4. (if active) would, damage / AW, cells / tissues, of pancreas ;	3 max
	(b)	(i)	<i>mark first two from ; ;</i> <ul style="list-style-type: none"> • age • gender • ethnic group • not, suffering from illness / diabetic / on medication • BMI / weight and height • time since previous meal 	2 max
		(ii)	$\frac{3.3 - 1.2}{30} = \frac{2.1}{30}$ 0.07 ;; <i>award two marks for correct answer if incorrect allow one mark for working</i>	2
		(iii)	<i>describe</i> 1. products of, protein / fat, digestion or acidic food ; 2. contact with duodenal, wall / cells ; <i>explain</i> 3. to stimulate secretion of, enzymes / named enzyme ; 4. from pancreas ; 5. to digest, food / chyme / named nutrient ; 6. causes, contraction / emptying, of gall bladder ; 7. to release bile ; 8. to emulsify fats ; 4 max	5 max
	(c)	1	<i>NB. no marks for description</i> (rise in glucose concentration) causes, β cells / pancreas / islets, to release (more) insulin ;	3 max
		2	(due to) increased uptake by, liver / muscle, cells ;	
		3	increased respiration (of glucose) ;	
		4	conversion to, fat / glycogen ;	
		5	due to negative feedback ;	
				[Total:16]

Question			Expected Answers	Marks						
2	(a)	(i)	oxidation / dehydrogenation / redox ;	1						
		(ii)	<u>ethanal</u> ; A acetaldehyde	1						
		(iii)	1. combines with CoA / forms acetyl CoA ; 2. combines with oxaloacetate / enters Krebs cycle ; 3. production of ATP ; 4. will be, dehydrogenated / decarboxylated ; 5. may be used to synthesise, fatty acids / ketones ;	3 max						
		(iv)	reduction / named reaction ; oxidative phosphorylation / ETC / chemiosmosis ;	2						
	(b)	(i)	any one from ; <ul style="list-style-type: none">heredityvirus/named virus<u>excess</u> alcoholmetastasis / descriptionhigh fat diet	1						
		(ii)	1. switch on, oncogenes / proto-oncogene → oncogenes ; 2. mutation ; 3. uncontrolled, cell division / mitosis ; 4. failure of cells to undergo, apoptosis / programmed cell death ; 5. (cells become) non-specialised ; 6. AVP ; e.g. carcinogen starts process	3 max						
	(c)	(i)	<table border="1"><tr><td>G</td><td>0.9</td><td>4.5</td><td>1.0</td><td>6.4 ;</td><td>5.0 ;</td></tr></table> <p>allow one mark for first four values and one mark for ratio allow ecf for ratio</p>	G	0.9	4.5	1.0	6.4 ;	5.0 ;	2
G	0.9	4.5	1.0	6.4 ;	5.0 ;					
		(ii)	heart disease / stroke / gallstones ;	1						
		(iii)	GHF ; ; Allow one mark for GFH	2						
				[Total:16]						

Question			Expected Answers	Marks
3	(a)	1	there is a link between the finger relationship and the risk of OA / AW ;	2 max
		2	(when) index shorter than ring, <u>double</u> / AW, the risk of OA ; <i>mp2 subsumes mp1</i>	
		3	men more likely at risk of OA / ora ;	
	(b)		ref. to comparison ;	1
	(c)		<i>causes</i> C1 overuse of joint / wear and tear ; C2 named leisure or occupational activity ; C3 ref. when young ; C4 joint injury / named example ; C5 obesity ; C6 cartilage (at end of bones) becomes rougher ; C7 collagen / glycoproteins, break down faster than are replaced ; C8 chondrocytes are, fewer / less active ; <i>max 4</i> <i>symptoms</i> S1 less joint movement / reduced flexibility in joint ; S2 painful joint movement ; S3 inflammation ; S4 bony spurs / calcification of joint ; <i>max 2</i> <i>treatment</i> T1 NSAIDs / glucosamine / named pain killer ; T2 joint replacement ; T3 inject, synovial fluid/stem cells / chondrocytes ;	7 max
			QWC – legible text with accurate spelling, punctuation and grammar;	1
	(d)		<i>structure</i> 1 fibrous protein ; 2 3 polypeptide chains (per molecule) ; 3 twisted around each other / AW ; 4 every third amino acid is glycine ; 5 therefore (polypeptide) chains lie close together ; 6 cross links / H bonds between chains ; 7 ref. staggering therefore no weak spot / AW ; <i>max 3</i> <i>properties</i> 8 good tensile strength ; 9 inelastic / non-stretchy ; 10 flexible ;	4 max
[Total: 15]				

Question			Expected Answers	Marks
4	(a)		P cerebrum / cerebral hemisphere / cerebral cortex ; Q cerebellum ; R medulla oblongata / brainstem ;	3
	(b)	(i)	1. maintenance of, constant / stable, internal environment ; 2. irrespective of changes in external environment ; 3. negative feedback / AW ;	2 max
		(ii)	1. ADH reduces the loss of water (from the body) ; 2. low (blood) <u>water potential</u> detected by, osmoreceptors / hypothalamus ; 3. stimulates ADH release ; 4. (ADH) acts on, collecting duct / DCT ; 5. cells of collecting duct, more permeable to water / reabsorb more water ; 6. into blood ; 7. lower volume of urine / hypertonic urine ; 8. AVP ; e.g. receptors / aquaporins	4 max
	(c)	(i)	1. overweight / obese increases (of Alzheimer's) ; 2. large waist increases risk ; 3. large waistline greater risk than overweight / AW ; 4. comparative figs. ;	3 max
		(ii)	<i>any one from</i> ; <ul style="list-style-type: none"> • high blood pressure / hypertension • heart disease • diabetes • osteoarthritis • cancer 	1
				[Total: 13]

Question		Expected Answers	Marks
5	(a)	normal vision controlled by dominant <u>allele</u> / ora ; parents heterozygous / AW ; child homozygous <u>recessive</u> ; (new) mutation ;	2 max
	(b)	rods ;	1
	(c)	correct labels ;; <i>accept correct names instead of T and C</i>	2
	(d)	<p>1 semicircular canals are concerned with movement ;</p> <p>2 orientated in three planes ;</p> <p>3 swelling at end / ampulla ;</p> <p>4 cupula (inside ampulla) ;</p> <p>5 head movement causes fluid move ;</p> <p>6 bends cupula to one side ;</p> <p>7 contain viscous fluid / endolymph ;</p> <p>8 hair cells / stereocilia / sensory hairs ;</p> <p>9 (fluid movement) pulls on stereocilia / sensory hairs ;</p> <p>10 depolarisation of <u>hair cells</u> ;</p> <p>11 action potential / impulses, in vestibular nerve ;</p> <p>12 action potentials / impulses, to brain ;</p> <p>13 idea that changes in patterns of these, impulses / action potentials, must relate to changes in movement ;</p> <p>14 AVP ;</p> <p><i>mark to max 7 if only refer to utricle and saccule</i></p>	8 max
		QWC - clear, well organised answer using at least 3 of the specialist terms (shown in bold) in correct context ;	1
	(e)	<p><u>hair cells</u> ;</p> <p>damage causes constant, depolarisation / release of neurotransmitter / action potentials / impulses ;</p> <p>AVP ; e.g. detail of damage</p>	2 max
			[Total: 16]

Question		Expected Answers	Marks
6	(a)	association ; stimuli ; immediate ; reward ; positive ; negative ; punishment ;	7
	(b)	<div> <i>act of behaviour</i> a dolphin is trained to perform a trick by being rewarded with a fish a puppy searches for its mother's teat a cat's foreleg jerks back when its paw touches a hot radiator whenever the toilet flushes in a house the shower becomes very hot and the person jumps back; eventually the sound of the toilet flushing causes the person to jump back </div> <div> <i>type of behaviour</i> operant conditioning ; innate / instinctive / stereotypic / not learned ; (spinal) reflex ; classical conditioning / conditioned reflex ; </div>	4
	(c)	1 ref. insight learning ; 2 use actions learned in unconnected situations / exploratory learning / AW, (to solve problems) ; 3 detail of activity ; e.g. stacking boxes 4 ref. planning ; 5 AVP ; e.g. higher form of learning / trial and error	3 max
			[Total:14]

2806/01 Unifying Concepts in Biology - Written Paper

Question		Expected Answers	Marks
1	(a)	mean figures calculated as 10, 19 and 43 ; temperature on x-axis and labelled y-axis ; units on axes ; points plotted and joined ;	4
	(b)	1 Q10 = 2 ; 2 <u>aerobic</u> respiration ; 3 (controlled by) enzymes ; 4 higher kinetic energy as temperature rises ; 5 enzymes and substrates move around faster ; 6 more, collisions / ESC formed ; 7 between enzyme's active site and substrate ; 8 more oxygen, used up / needed ; 9 for oxidative phosphorylation ;	5 max
	(c)	(humans) warm-blooded / homeothermic / homeostatic ; (body maintained at) 37 °C ; (therefore) metabolic rate relatively constant / AW ;	2 max
	(d)	increased, movement / swimming ; shivering ; fever ; increased depth / pressure ; fear / excitement ; adrenaline ;	3 max
			[Total: 14]

Question			Expected Answers	Marks
2	(a)	(i)	121/12 600 X 100 ; 0.96/1 % ;	2
		(ii)	some, producers / AW, die ; producers / AW, respire / metabolise / use ATP ; not all of the producers consumed ; not all parts of producers digested ;	3 max
		(iii)	smaller amount of energy enters primary consumer level in total ; 25 (marine) and 8 (forest) ; fewer / less biomass of, primary consumers compared to producers ; ora percentage / proportion, heat loss in metabolism roughly same at both levels ; (about) 50% ;	2 max
	(b)	1	trees, convert more light → chemical energy / fix more energy in photosynthesis ;	max 7
		2	0.96% c.f. 0.80% ;	
		3	tree / leaf, adaptation to maximize light capture described ;	
		4	photosynthetic pigments different in plants to phytoplankton ;	
		5	water, reflects / absorbs, some light wavelengths ;	
		6	reducing light available for photosynthesis in phytoplankton ;	
		7	6 - 7% energy in tree passed to herbivores (insects) / AW ;	
		8	36 - 37% energy in phytoplankton passed to herbivores (shrimps) / AW ;	
		9	tree, bark / wood / roots, may not be, eaten / digested ;	
		10	whereas algal cells totally, edible / digestible ;	
		11	fewer algal cells left to die as easier to, find / graze ;	
		12	12 - 13% energy in insects passed to birds / AW ;	
		13	32% energy in shrimps passed to fish / AW ;	
		14	less energy lost due to death from shrimps (16% versus 38%) ;	
		15	shrimp easier to catch and eat ;	
		16	no hiding places ;	
		17	more shrimp grazed than insects ;	
		18	B / marine community, more efficient flow between trophic levels / more likely to have tertiary consumers ;	
			QWC – legible text with accurate spelling, punctuation and grammar ;	1
[Total: 15]				

Question			Expected Answers	Marks
3	(a)	(i)	same leaf area (lost in both) ; ref. photosynthesis ; ref. effect on, growth / seed production / nicotine content ;	2 max
		(ii)	hypothesis is supported ; insect damage associated with higher nicotine content ; in both types of soil ; figures quote ; (1.09 vs 1.37, or 0.67 vs 0.98, or 26% increase vs 46% increase)	3 max
	(b)		(less) N for, amino acids / proteins ; relate to role of protein in seeds ; e.g. cytoplasm / enzymes / cell membranes / food store (less) N for, nitrogenous bases / (named) nucleotides / DNA / RNA ; relate to role of these in making seeds ; e.g. DNA replication / protein synthesis / meiosis / mitosis / respiration (less) N for chlorophyll ; relate to less, photosynthesis / food resources, for making seeds ; <i>If candidate refers to N₂, penalise once</i>	3 max
	(c)	(i)	1 binding causes, stimulation / action potential / AW, (in neurone / muscle cell) ; 2 makes muscles contract ; OR 3 stops, stimulation / action potentials / AW / blocks receptors ; 4 muscles can't contract ; 5 paralysis ; 6 (nicotine not broken down so) effect prolonged / permanent / AW ; 7 relate to, breathing movements / feeding / moving to escape ;	3 max
		(ii)	dose received too small / AW ; only a few receptors affected ; smoking-related diseases / named, are chronic / AW ;	1 max
		(iii)	increases blood pressure ; increases stickiness of platelets ; increases, atherosclerosis / description ; ref. coronary arteries ; thrombosis ; heart attack / stroke ;	4 max
				[Total: 16]

Question			Expected Answers	Marks
4	(a)	(i)	no, nucleus / nuclear membrane ; no membrane-bound organelles ; circular DNA ; naked DNA / no histones ; cell less than 1µm ; small (18nm/70S) ribosomes ; bacterial / peptidoglycan / murein, cell wall ; AVP ; other valid prokaryote feature such as mesosome, plasmids	3 max
		(ii)	Latin, universal / same, name all over world ; first name / genus, shows relationship to other close species ; second name / species, unique to this species ;	2 max
	(b)		number of erythromycin doses was increasing up to 1988 ; falls, in 1989 / after 1988 ; largely a downward trend since ; ref. plateau ; campaign has been successful ; figs. to support ;	3 max
	(c)	(i)	mutation ; resistant bacteria brought in from elsewhere ; conjugation / horizontal transfer / plasmid, from a different species ; transformation ;	1 max
		(ii)	1. natural selection / ref. selection pressure ; 2. resistant bacteria, selected for / have advantage / outcompete rest ; 3. as erythromycin kills other strains / only resistants, survive / are left ; 4. (resistants) reproduce ; 5. increasing numbers with, plasmid / resistance gene, (in population) ; 6. ref., asexual reproduction / binary fission / cloning, (in bacteria) ; 7. time lag between erythromycin used falling and % resistant infections falling ;	4 max
		(iii)	erythromycin now less of a selection pressure ; non-resistant, survive / have selective advantage / out-compete resistant strains ; ora bacterial resources not used for resistance ; may be diverted to, growth / reproduction ;	2 max
				[Total: 15]

2806/03 Practical Examination

Planning Exercise

The mark scheme for the planning exercise is set out on page 49 and 50. The marking points **A** to **U** follow the coursework descriptors for Skill P.

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 51 to 54 have the mark scheme for Questions 1 and 2 for the Practical Test.

A2 Biology. Planning exercise

Checking Point	Descriptor	The candidate
A	P.1a	Plans a suitable procedure to determine oxygen uptake of at least three stages of development of blowfly at min of three temperatures ;
B	P.1a	Gives a prediction about the effect of temperature on the rate of respiration of at least two stages of development ; <i>accept from a graph</i>
C	P.1b	Selects suitable equipment and materials, to include apparatus to give different temperatures, thermometer, a ruler and a stopwatch/clock ;
D	P.3a	States that respiration in, ectotherms / poikilotherms / insects / flies, is determined by the external temperature ;
E	P.3a	Identifies at least 2 key factors to control ; e.g. mass of larvae / pupae, mass of soda lime, stated time for acclimatisation and measuring uptake of oxygen
F	P.3b	Decides on an appropriate number of measurements to take: minimum of five different temperatures ;
G	P.3b	Decides on a suitable range of temperatures minimum of 30 °C ; e.g. 4 °C to 40 °C
H	P.3b	Describes a way of obtaining reliable results by using a minimum of three batches of larvae / pupae for each temperature / three 'runs' with same batch after refreshing air in syringe each time ;
I	P.5a	Uses appropriate A2 scientific knowledge and understanding in developing a plan ; e.g. glycolysis, Krebs cycle, oxidative phosphorylation, respiratory substrates
J	P.5a	Uses preliminary work or previous practical work in developing a plan ;
K	P.5a	Refers to a hazard and an appropriate precaution ;
L*	P.5b	<i>Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC) ;</i>
M	P.5b	Describes way(s) of obtaining precise results ; e.g. measuring in mm, use long distance on tube to reduce percentage error
N	P.7a	Uses relevant information from any two written sources ; e.g. class notes / text book / web site, etc. <i>must be cited in plan</i>
O	P.7a	Shows how results are to be presented in table including correct use of units for temperature, distance and rate of, respiration / oxygen uptake;
P*	P.7a	<i>Uses spelling, punctuation and grammar accurately (QWC) ;</i>
Q	P.7a	Uses AS knowledge and understanding ; e.g. the effect of temperature on enzymes, gaseous exchange (in blowflies)
R	P.7b	Shows summary graph of rate of respiration against temperature / stages (or age) for the different stages (or ages) / temperatures investigated ;
S	P.7b	Comments on precision ; e.g. marking and reading the capillary tubing / measuring rate per gram of animal not per animal
T	P.7b	Comments on reliability ; e.g. explains need to run replicates of each set of conditions
U	P.7b	Comments on validity ; e.g. respiration may be anaerobic and aerobic / effect of exhaustion of oxygen in respirometer / acclimatisation / describe or justify control respirometer
V	P.7b	Shows how rate of respiration in $\text{mm}^3 / \text{cm}^3$, min^{-1} or mm min^{-1} is calculated ;

Point mark up to **14** by placing letters **A** to **U** **excluding L and P** in the margin at appropriate points. Then award **1** mark for each of **L** and **P** (QWC).

Total: 16

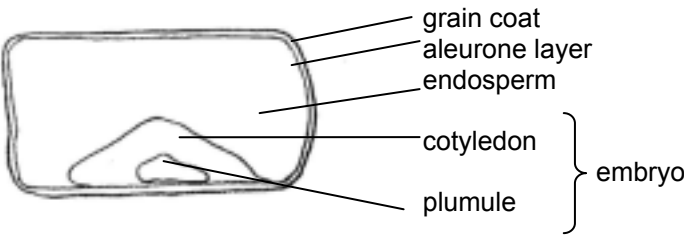
Further elaboration of checking points

A	Minimum is three stages of development at three different temperatures
B	A for minimum of two stages of development
C	Not respirometers, A thermostatic(ally)-controlled water baths or incubators for thermometer, accept a graduated capillary tube or pipette / graph paper / scalafix for a ruler
D	
E	A species, number of larvae/pupae <i>look for</i> minimum of 5 minutes for acclimatisation / result taking, minimum of 5 larvae / pupae
F	
G	minimum for range is 30 °C
H	R 'repeat twice' / 'carry out three times' unqualified A if it is clear the whole procedure is repeated as this will include setting up the respirometer with fresh air
I	R the effect of temperature on enzymes unqualified as AS, but A the effect of temperature on respiratory enzymes with some detail
J	Must be evidence of preliminary work, not a hypothetical pilot study
K	A ref to maggots and allergies / disease + wash hands / use disinfectants A ref to soda lime, corrosive / irritant + gloves or acceptable alternative
L*	
M	e.g. <i>scalafix</i> stuck on capillary tubing or graduated tubing or use of graph paper R 'how to read the meniscus'
N	
O	rate should be mm s ⁻¹ or mm min ⁻¹ or volume per unit time. Could be 1000/t or s ⁻¹ if timed movement of meniscus over set distance. If volume, check to see if V can be awarded as well A split tables
P*	
Q	ref to collision theory / enzyme-substrate complexes / denaturation and breakage of named bonds, A any good detail of biology of blowfly larvae / pupae, ice crystals and breakage of membranes
R	graph must have labelled axes with units , A 1/t must say that results for different stages / temperatures are plotted on the same pair of axes. ecf for oxygen uptake in mm if time is standardised, R if time for standardised distance (P2)
S	calculates rate per gram of maggot / calculates volume of oxygen absorbed R ref to stats tests
T	must be different respirometers or same respirometer with different batches of larvae / pupae A leave respirometer until three results are the same / allows anomalies to be identified
U	A discussion of different substrates / RQ which could influence volume of oxygen absorbed reason for acclimatisation must be given
V	$\pi r^2 h$, explains that r = radius, h = distance travelled by, meniscus / bubble may be expressed per gram of blowfly tissue (if so award S) may be calculated from a graph of distance against time

Question		Expected Answers	Marks
Typical results for Q.1 (a)			
Plant material	Time taken to collect 5 cm ³ gas / s	Rate of gas production / cm ³ s ⁻¹	
A Celery	11	0.455	
B Carrot	132	0.038	
C Potato	23	0.217	
D Lettuce	51	0.098	
E Mung beans	4	1.250	
F Apple	255	0.019	
1	(a)	<p>table format with column headings ; <i>sample/material, time, (volume), rate..., order...</i></p> <p>materials in the left hand column ; <i>ignore letters A to F</i> units in column headings ; R if in body of table cm³, min or s, cm³ min⁻¹ or s⁻¹ or 1/t volumes recorded ; rates calculated correctly and shown consistently ; (e.g. to same number of decimal places / sig figs if stated) A cm³ min⁻¹/cm³ s⁻¹ or 1/t order of activity matches rates ; A times if rates not calculated or incorrect</p>	6
	(b)	accept ora for marking points 1 to 4	
		<p>1 fast rate of gas production represents high (metabolic) activity / AW ; 2 (thus) large concentration of, enzyme / catalase, in material or enzymes are most active ; 3 because there is a high rate of, metabolism / respiration ; 4 tissue generates hydrogen peroxide ;</p> <p><i>reasons must correspond to the candidates order of metabolic activity</i></p> <p>5 little / no, (metabolic) activity in apple ; 6 no catalase / inhibitor / pH unfavourable / not ripe / AW ; A storage organ</p> <p><i>award marks for each material with reference to activity and reason</i></p> <p>7 metabolic activity in mung bean seeds (due to) high rate of respiration ; 8 any further detail ; e.g. (provide energy for) germination</p> <p>9 metabolic activity in celery (due to), transport tissue / rapid growth / photosynthesis ; 10 any further detail ; e.g. active movement in phloem</p> <p>11 metabolic activity in lettuce (due to) photosynthesis ; 12 any further detail ; e.g. source</p> <p>13 metabolic activity in, carrot / potato, (due to) storage tissue / (no) growth / mobilisation ; A transport for carrot/uptake 14 any further detail ;</p>	10 max

(c)	<p>determine respiratory rate by measuring, oxygen uptake / carbon dioxide output ;</p> <p>use a <u>respirometer</u> ;</p> <p>outline of method (could be from Plan) ;</p> <p>e.g. green plant material in the dark ;</p> <p>determine, density / numbers of, mitochondria ;</p> <p>(by taking) EMs of materials ;</p> <p>any further detail ; e.g. random sampling of tissue / number of cristae per mitochondrion</p> <p>homogenisation of material ;</p> <p>centrifugation to isolate mitochondria ;</p> <p>measure, mass / size, of pellet ;</p> <p>any further detail ; e.g. differential centrifugation</p> <p>use, redox indicator / TTC / methylene blue ;</p> <p>homogenisation of material ;</p> <p>determine rate of colour change ;</p> <p>any further detail ; e.g. colour standard for end point/temperature control</p>	5 max
	<p>plot scattergraph to see if rates of respiration are correlated ;</p> <p>further detail ; e.g. correlation coefficient</p>	2

(d)	limitations		improvements
L1	no control ;	I1	use 5 cm ³ water or 5 g of inert material ;
L2	mass of plant material different because difficult to transfer all material ;	I2	use the same mass / record the mass ; A weigh the chopped material so it is the same
		I3	calculate rates per gram of tissue ;
L3	variable quantity of, water / air, in fresh materials ; A densities	I4	determine dry mass of similar quantity of material and express results on dry mass basis ;
L4	initial rate not determined ;	I5	take measurements at intervals and determine initial rate ;
L5	different particle sizes / surface area not standardised / ref to mung beans ;		liquidise all the tissues / AW ;
		I6	
L6	substrate cannot reach all catalase molecules at same rate / AW ;		
L7	disturbing / shaking, tube may release a rush of oxygen ;	I7	use homogenate (and stir before use) ; (do not award if I6 awarded)
L8	air pressure / temperature, may vary and influence volume of gas ;	I8	use water bath to keep, temperature / pressure, of reaction flask constant ;
L9	stated problem with timing ; e.g. when bubbles first appear	I9	stated alternative method ; R use two people
L10	difficult to read the scale on the syringe barrel ; R accuracy unqualified		use container with finer graduations / use gas syringe ; A graduated pipette
		I10	
L11	scale not precise enough / not enough graduations / AW ;		
L12	no repeats / should be repeated ;	I11	minimum of three repeats, calculate means ;
L13	room temperature used / temperature not controlled ;	I12	put boiling tube into <u>thermostatically-controlled</u> water bath ;
		I13	equilibrate tissues and hydrogen peroxide ;
L14	contamination from, scalpel / white tile ;	I14	wash / wipe, scalpel / tile, each time ; A use new
L15	pH not controlled / tissues may have different pH ;	I15	use a buffer solution ;
L16	AVP ; e.g. maybe not at optimum pH	I16	AVP ; e.g. test for optimum pH first
			11 max
			[Total: max 30]

Question		Expected Answers	Marks
2	(a)	grain in iodine solution = dark blue / blue / black / blue-black, in endosperm ; grain stained in Sudan III = red / AW, in embryo ;	2
	(b) (i)	carbohydrate / starch, (mostly) in <u>endosperm</u> ; lipid (mostly) in <u>embryo</u> ;	2
	(ii)	<ol style="list-style-type: none"> 1 energy, supply / source / store ; R food source 2 respiratory substrate / needed for respiration / ATP synthesis ; 3 for, germination/growth of embryo ; <i>must be linked to 1 or 2</i> 4 starch is a source of glucose ; 5 glucose is needed as monomer for, e.g. cellulose / other sugars ; 6 lipid is a source of fatty acids (and glycerol) ; 7 for lipid synthesis in embryo ; 8 e.g. phospholipids in membranes ; 9 AVP ; e.g. ref to gibberellin / lipid converted to carbohydrate 	4 max
	(c)	<p><i>quality of drawing</i> clear, continuous, sharp lines for drawing ; A single line for edge of grain correct, proportions of tissues / shape of grain ; two areas (cotyledon and plumule) drawn in embryo ;</p> <p><i>labels</i> fruit coat/grain coat / aleurone layer / AW ; embryo and endosperm tissues labelled ;</p> 	5
	(d) (i)	embryo / description of ; A point of attachment edge of the endosperm / aleurone layer / edge of grain ; A 'around outside'	2
	(ii)	<p><i>accept ecf from (i)</i></p> <ol style="list-style-type: none"> 1 bubbles indicate site of catalase ; 2 (embryo / aleurone layer) regions metabolically active ; 3 ref to anabolic reactions / named e.g. protein synthesis ; 4 ref to aleurone layer and synthesis of proteins ; 5 ref to action of gibberellin ; 6 ref to catabolic reactions / named e.g. ; A respiration / glycolysis / Kreb / oxidative phosphorylation / hydrolysis of starch ; 7 endosperm / rest of grain, is (only an) energy store ; 8 embryo / grain, is, germinating / growing ; 9 AVP ; e.g. named enzyme(s) 	4 max
[Total: max 14]			

Grade Thresholds

Advanced GCE (Subject) (Aggregation Code(s))
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
2804	Raw	90	62	55	49	43	37	0
	UMS	90	72	63	54	45	36	0
2805 A	Raw	90	61	54	47	40	34	0
	UMS	90	72	63	54	45	36	0
2805 B	Raw	90	64	57	50	44	38	0
	UMS	90	72	63	54	45	36	0
2805 C	Raw	90	62	56	50	45	40	0
	UMS	90	72	63	54	45	36	0
2805 D	Raw	90	65	58	51	44	38	0
	UMS	90	72	63	54	45	36	0
2805 E	Raw	90	64	57	51	45	39	0
	UMS	90	72	63	54	45	36	0
2806 A	Raw	120	86	77	68	59	51	0
	UMS	120	96	84	72	60	48	0
2806 B	Raw	120	86	77	68	59	51	0
	UMS	120	96	84	72	60	48	0
2806 C	Raw	120	78	69	60	51	43	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	13.5	24.3	45.9	64.9	94.6	100.0	40
7881	9.7	34.4	67.3	87.6	98.0	100.0	714

754 candidates aggregated this series

For a description of how UMS marks are calculated see:
<http://www.ocr.org.uk/learners/ums/index.html>

Statistics are correct at the time of publication.

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