

Human Biology

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

Mark Schemes for the Units

June 2009

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Advanced Subsidiary GCE Human Biology (3886)

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2856 Blood, Circulation and Gaseous Exchange

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	X artery and Y vein ;	1	
		(ii)	5 ; ;	2 max	If answer rounded incorrectly allow one mark OR If answer incorrect allow one mark for $40 - 42 \div 8$
		(iii)	(provides a) smooth surface ; reduces friction / AW ; reduces adherence of substances / reduces risk of clots forming ; secretion of anticlotting agents ;	2 max	ACCEPT smooth DO NOT CREDIT 'allows blood to flow easily' – look for idea of reducing resistance ACCEPT cholesterol, platelets
	(b)	(i)	(more) cholesterol production ; by liver ; (more) LDLs produced / present ; (LDLs / cholesterol) deposited <u>in</u> , artery <u>wall</u> ; AVP ;	3 max	DO NOT CREDIT on wall e.g. (cholesterol) taken up by foam cells
		(ii)	hypertension ; increasing age ; smoking ; genetic pre-disposition / AW ; diabetes ; AVP ; AVP ;	2 max	ACCEPT high blood pressure ACCEPT old age e.g. lack of exercise, named medication (e.g. contraceptive pills), (prolonged) stress, obesity, being male, <u>high</u> alcohol intake
			Total	10	

Question			Expected Answers					Marks	Additional Guidance
2	(a)		molecule	example	subunit(s)	chemical elements present	bond between subunits		
			protein	catalase	amino acids ;	C, H, O, N	peptide ;		
			lipids	triglyceride	fatty acid(s) <u>and</u> glycerol ;	C,H,O ;	ester		
			carbohydrate ;	glycogen	monosaccharides	C,H,O	glycosidic ;		
	(b)	(i)	calcium <u>ions</u> / Ca^{2+} ;					6 1	
		(ii)	binds with enzyme / active site ; may alter shape of active site ; allows substrate to bind with active site ; allowing the formation of <u>enzyme substrate complexes</u> ; reduces activation energy ; AVP ;					3 max	Look for idea of attachment ACCEPT combine with enzyme e.g. allosteric ref. to thrombin action
	(c)		respiratory substrate / AW ; energy storage (in adipose cells) ; converted to phospholipids / AW ; converted to, lipoproteins / AW ; AVP ;					2 max	ACCEPT release energy DO NOT CREDIT component of cell membrane – look for idea of formation of different molecules e.g. converted to steroids

Question			Expected Answers	Marks	Additional Guidance
2	(d)		<p>isotonic drinks have the same concentration of solute as, blood plasma / cells ;</p> <p>details of content (e.g. glucose / electrolytes) ;</p> <p>during exercise, ions / water, lost ;</p> <p>ref to replacing, water / salts / ions / minerals ;</p> <p>maintains blood volume / prevents dehydration ;</p>	4 max	<p>DO NOT CREDIT same water potential</p> <p>this is the lower mark and be awarded with m.p. 4</p> <p>DO NOT CREDIT maintains water potential</p>
			Total	16	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	<p>ref to appropriate safety procedure(s) ; place a drop blood, onto microscope slide ; smear / spread blood across slide ; with a, second slide / spreader ; dry in air ; fix with alcohol ;</p> <p style="text-align: right;"><i>4 max</i></p> <p>named stain e.g. Leishman's ; leave for 2 minutes ; (after stain) add water ; leave for 5 - 7 minutes ;</p> <p>add water again to wash off extra stain ; blot (with filter paper) ;</p> <p style="text-align: right;"><i>4 max</i></p> <p>QWC ;</p>	<p>7 max</p> <p>1</p>	<p><i>accept marking points from suitably labelled diagrams</i></p> <p>ACCEPT 'leave to dry' for this marking point alcohol must be before stain / water</p> <p>ACCEPT range 1-5 minutes ACCEPT a few minutes water must be after stain ACCEPT a few minutes – without addition of water only credit leaving for a time period once</p> <p>look for second addition of water for this mark</p> <p>Candidates should have no more than three different spelling errors, sentences should be accurately punctuated according to spoken English and the text should be legible.</p>
		Total	8	

Question			Expected Answers	Marks	Additional Guidance																				
4	(a)		epithelial ; elastic ; breathing ; diffusion ; soluble ; COPD ;	6																					
	(b)		<table><tr><td>disease</td><td>acute</td><td>chronic</td><td></td></tr><tr><td>tuberculosis</td><td>(✓)</td><td>✓</td><td>;</td></tr><tr><td>asthma</td><td>✓</td><td>✓</td><td>;</td></tr><tr><td>emphysema</td><td></td><td>✓</td><td>;</td></tr><tr><td>lung cancer</td><td></td><td>✓</td><td>;</td></tr></table>	disease	acute	chronic		tuberculosis	(✓)	✓	;	asthma	✓	✓	;	emphysema		✓	;	lung cancer		✓	;	4	for tuberculosis allow a tick or cross for acute – look for chronic tick
disease	acute	chronic																							
tuberculosis	(✓)	✓	;																						
asthma	✓	✓	;																						
emphysema		✓	;																						
lung cancer		✓	;																						
			Total	10																					

Question	Expected Answers	Marks	Additional Guidance
5	<p><i>rough endoplasmic reticulum</i> (provides) large surface area ; protein / polypeptide, synthesis ; named protein ; transports, polypeptides / proteins ;</p> <p style="text-align: right;"><i>2 max</i></p> <p><i>nucleus</i> contains, genetic information / DNA ; controls cell, metabolism / AW ; site of RNA production ;</p> <p style="text-align: right;"><i>2 max</i></p> <p><i>Golgi apparatus</i> protein modification ; formation of glycoproteins ; production of (secretory) vesicles ; production of lysosomes ;</p> <p style="text-align: right;"><i>2 max</i></p>	6 max	<p>ALLOW production of proteins</p> <p>ACCEPT produces (transport) vesicles</p> <p>DO NOT CREDIT 'acts like the brain' ALLOW functions ALLOW 'controls what the cell does'</p> <p>ALLOW 'packages proteins'</p>
	Total	6	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	<p>K / lub, atrioventricular valves (close) ; (caused by) ventricular contraction ; suitable ref to pressure changes ;</p> <p>L / dub, semi-lunar valves (close) ; (caused by) ventricular relaxation ; suitable ref to pressure changes ;</p> <p>(heart sounds occur when) valves <u>close</u> ;</p>	4 max	<p>ACCEPT bicuspid contraction must be in context of an effect on valves</p> <p>ACCEPT aortic valve contraction must be in context of an effect on valves</p>
	(b)	<p>ensures that the ventricles are filled with blood (before they contract) ; so that, sufficient / maximum / more, blood is ejected from the heart, each beat / when ventricles contract / AW ; AVP ;</p>	2 max	<p>idea of filling required</p> <p>e.g. relationship between stretch and increased force of contraction</p>
	(c)	<p>same trend / AW ; lower pressure (throughout) / AW ; (because) right ventricle wall thinner / AW ; lower force generated, by muscle ;</p> <p>(right ventricle) pumps to, lungs / pulmonary circuit, only ; less peripheral resistance ;</p>	4 max	<p>ACCEPT reverse argument throughout</p> <p>ACCEPT less distance</p>
		Total	10	

PAPER TOTAL: 60

2857 Growth, Development and Disease

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	prophase ;	1	
		(ii)	anaphase ;	1	
		(iii)	interphase / G2 ;	1	
	(b)		genetically identical / clone ; same number of chromosomes as parent cell / AW ; (usually) diploid ;	2 max	
	(c)		stops mitosis ; chromosomes can't line up ; chromatids not pulled apart ; correct ref. to phase ; new daughter cells cannot form / AW ;	3 max	
	(d)		forms gametes / sex cells ; produces, haploid cells / cells, with half the original number of <u>chromosomes</u> ; so that, diploid / correct number restored / stops number of chromosomes doubling ; at fertilisation ; a source of genetic variation ; AVP ;	3 max	mechanism of genetic variation example e.g. independent assortment / crossing over / recombination
			Total	11	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		airborne / AW ; infected person / person with (active pulmonary) TB , exhales / breathes out / talks / sneezes / coughs / spits, releasing droplets ; inhaled / breathed in, by another person ; drinking milk from cattle infected with TB bacteria ; prolonged / close / repeated contact, with infected person ;	2 max	
	(b)		HIV, weakens / attacks, the immune system ; destroys T helper cells ; more, susceptible / likely to, develop TB / TB as opportunistic infection ; greater prevalence of TB increases rate of spread ; AVP ;	2 max	e.g. additional detail of how immune system compromised

Question		Expected Answers	Marks	Additional Guidance
2	(c)	<p>1 improve, housing / living conditions / sanitation ;</p> <p>2 improve, diet / prevent malnutrition ;</p> <p>3 access to, diagnosis / screening / Heaf test / AW;</p> <p>4 use of, vaccines / vaccination / immunization programme ;</p> <p>5 use of antibiotics ;</p> <p>6 to develop, new drugs / antibiotics (to combat drug resistance) ;</p> <p>7 isolation of infected person ;</p> <p>8 provide extra resources for, health care / diagnosis, of patients with TB ;</p> <p>9 set 'reduction in number of cases of TB' as a target ;</p> <p>10 use of DOTS programmes ;</p> <p>11 detail of DOTS programme ;</p> <p>12 treat patients with HIV with antiretroviral drugs ;</p> <p>13 provide financial support for poor countries for, more health workers / medical centres / drugs ;</p> <p>14 collect / collate, epidemiological (prevalence / incidence) data / monitoring of cases ;</p> <p>15 TB as notifiable disease / described ;</p> <p>16 educate about disease, prevention / spread ;</p> <p>17 production of health advice for travellers / AW ;</p> <p>18 contact tracing idea ;</p> <p>QWC ;</p>	<p>9 max</p> <p>1</p>	<p>Clear and well organised using three of the emboldened terms. Allow derivations of terms in bold for QWC mark.</p>
Total			14	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	<p>infrared radiation / body heat / produce image / photograph / heat map ;</p> <p>different amounts of heat produce different colours ;</p> <p>cancer (cells) / tumour, produce more heat than normal cells ;</p> <p>appear as a 'hot spot' / AW ;</p> <p>higher metabolic rate produces more heat ;</p> <p>cancer cells have a higher metabolic rate ;</p>	3 max	
	(b)	<p>extra heat may be a result of, infection / pregnancy / menopause / lactation / other causes ;</p> <p>can give false results ;</p> <p>some cancers too small to be detected by this method ;</p>	1 max	
	(c)	<p>lumpectomy / partial mastectomy ;</p> <p>cancer / tumour removed ;</p> <p>with border of normal tissue ;</p> <p>mastectomy ;</p> <p>removal of whole breast ;</p> <p>lymphectomy / removal of lymph nodes ;</p> <p>lymph glands removed if cancer cells have spread to glands ;</p>	4 max	

Question			Expected Answers	Marks	Additional Guidance
3	(d)	(i)	prevalence of breast cancer increases with age ; big increase after 40 – 44 ; (in white women) highest number of cases at 65 – 69 / number of cases falls slightly after 69 in both sets ; number of cases falls slightly at 60-64 in both sets ; (in Asian women) number of cases plateaus after 55- 59 ; more cases of breast cancer in white woman than Asian women ; comparative figures to support answer ;	3 max	<i>comparative figures example:</i> prevalence in white women increases from 25 per 100 000 at 30 – 34 to 190 per 100 000 at 65 – 69
		(ii)	263 ; ;	2	ACCEPT 262 If answer incorrect, CREDIT 1 mark for: 75 X 350 000 divided by 100 000 / 75 X 3.5 One mark for 262.5
			Total	13	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	plasma cell ;	1	
		(ii)	mitosis ; clonal expansion ; differentiation / AW ; AVP ; e.g. clonal selection	2 max	CREDIT 'becomes specialised'
	(b)		<i>variable regions:</i> antigen binding site / AW ; specific / complementary to antigen ; <i>hinge:</i> flexible to allow antigen to bind / AW ; <i>constant regions:</i> determines the mechanism used to destroy the antigen ; attaches to phagocyte ;	3 max	
	(c)		<i>secondary response / ora</i> produces more antibodies ; antibodies produced, at a faster rate / more quickly ; antibody concentration stays higher for longer ; use of comparative figures ;	2 max	<i>example of comparative figures:</i> maximum antibody concentration after first exposure is just over 10^1 arbitrary units and after second exposure just over 10^4 arbitrary units

Question			Expected Answers	Marks	Additional Guidance
4	(d)		<p>natural immunity as a result of being infected with the, disease organism / pathogen ;</p> <p>artificial immunity by being, vaccinated / injected, with ;</p> <p>antigen / antibody / inactivated toxin OR a, weakened / dead, form of the pathogen ;</p> <p>natural immunity causes a stronger immune response ;</p> <p>natural immunity lasts for longer ;</p>	3 max	DO NOT CREDIT disease on its own
			Total	11	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		trees felled to, sell / export / use ; cleared to provide land for, agriculture / cash crops ; cleared to build villages ; cleared for building roads ; cleared for, mining / industrial, use ;	3 max	ACCEPT example of 'use' of trees described
	(b)	(i)	plants contain chemicals ; that can be used as, drugs / medicines / treatment / herbal remedy ; to treat disease ; named, drug / herbal remedy ; make derivatives / purify / modify raw material ;	3 max	
		(ii)	loss of local tribes ; knowledge passed on by word of mouth / no written record ;	2 max	
	(c)		ban on importing wood from tropical rainforest ; control of land use ; introduce labelling system for origin of wood ; international sanctions on countries that continue to chop down rainforest ; financial support for, setting up / using, sustainable forestry / AW ; setting up reserves / AW ; development of ecotourism ; education about the importance of the rainforest ; sustainable farming ; recycling of, wood / paper based resources ; provide alternatives for local people ;	3 max	e.g. logging, agriculture, building e.g. replanting trees e.g. income source, food source
			Total	11	

PAPER TOTAL: 60

2858/01 Case Studies

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	X = carboxyl / carboxylic acid (group) ; Y = amino / amine (group) ;	2	
		(ii)	circle round the CH ₃ group ;	1	DO NOT CREDIT circle around part of the group
	(b)		peptide ; sense ; alpha helix / beta (pleated) sheet ; hydrogen ; R groups ; 4 ; quaternary ;	7	ACCEPT 'a' helix ACCEPT side chains / named group ACCEPT phonetic spelling
	(c)		(genetic code is) degenerate ; (most) amino acids have more than one triplet / AW ; (most) more than one transfer / t, RNA ; mutation not within gene / AW ;	2 max	CREDIT 'some amino acids have more than one codon' DO NOT CREDIT 'there is a different code for some amino acids'

Question			Expected Answers	Marks	Additional Guidance
1	(d)	(i)	brighter red / AW ;	1	ACCEPT comparative idea such as not as dark , less purple DO NOT CREDIT 'red instead of blue'
		(ii)	less (aerobic) respiration ; (more) <u>anaerobic</u> respiration ; fatigue / AW ; lactate / AW, build up ; less carbon dioxide removed ; muscle cramps ;	3 max	DO NOT CREDIT 'cannot respire' or 'no respiration' ACCEPT 'less respiration' - note the word 'aerobic' is not essential for this mp.
	(e)		blood diluted ; detail ; description of haemocytometer ; detail of use ; systematic counting described ; repeat counts ; detail of calculation ;	4 max	Blood sample is diluted with saline OR 1:200 gets two marks. ACCEPT reference to volumes used e.g. description of grid or known volume over a grid e.g. setting up to see Newton's rings e.g. left hand rule OR count within triple lines e.g. take a mean OR multiply by dilution factor

Question			Expected Answers	Marks	Additional Guidance
1	(f)		UGA corresponds to ACT ; ACT (mutates) to ACC ; UGA to UGG ; tryptophan coded for ; ref to (base) substitution ;	3 max	DO NOT CREDIT substitution if given as part of a list along with addition and deletion
			Total:	23	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	<p>(determined by) presence of <u>antigens</u> ;</p> <p>(on) red blood cell / erythrocyte , surface membrane ;</p> <p>match named antigen(s) to named blood group ;</p> <p>Blood group O, lacking AB antigens ;</p> <p>ref to further blood groups ;</p> <p>AVP ;</p>	3 max	<p>ACCEPT plasma membrane OR surface DO NOT CREDIT red blood cell, erythrocyte or membrane alone.</p> <p>e.g. Blood group A has antigen A</p> <p>DO NOT ACCEPT 'no antigens'</p> <p>CREDIT if reference is made to the four ABO blood groups A,B,AB and O OR to Rhesus blood group</p> <p>e.g. correct antibody in plasma e.g. detail of genetic determination</p>
	(b)	<p>(bone marrow contains) stem cells ; (stem cells become) specialised ;</p> <p>detail of specialisation ;</p> <p>detail of control of specialisation ;</p> <p>detail of cell changes ;</p>	3 max	<p>e.g. neutrophils for phagocytosis</p> <p>e.g growth factors, genes being switched in</p> <p>e.g. acquires many lysosomes/granular cytoplasm / lobed nucleus (for neutrophils)</p>
	(c) (i)	DNA replication ; transcription / described ;	1 max	<p>DO NOT CREDIT protein synthesis DO NOT CREDIT transcription if given as part of a list 'transcription and translation'</p>
	(ii)	two, chromatids ; (joined by) a centromere ;	2	CREDIT answers on a labeled diagram

Question			Expected Answers	Marks	Additional Guidance
	(c)	(iii)	mutation , in bone marrow cells / not in gamete production ; mutation / AW , occurs during mitosis ; somatic mutation ;	2 max	CREDIT reverse argument 'mutation does not occur in meiosis'
	(d)		1 competitive inhibitor ; 2 inhibitor shape similar to substrate ; 3 binds temporarily ; 4 blocks, active site / described ; 5 non-competitive inhibitor ; 6 binds elsewhere on the enzyme ; 7 distorts active site ; 8 ref. to ripple effect ; 9 prevents, ESC formation ; 10 slows down reactions ; 11 AVP ;	7 max	DO NOT CREDIT mp 1 and 5 if used to with incorrect mechanism DO NOT CREDIT same shape DO NOT CREDIT 'binds to active site' for this mark ACCEPT 'binds so it prevents substrate binding' CREDIT if shown in a labeled diagram CREDIT active site changes shape DO NOT CREDIT enzyme changes shape ESC for enzyme substrate complex e.g. ref to allosteric site OR ref to tertiary structure

Question		Expected Answers	Marks	Additional Guidance
	(e)	262 ; ;	2	If answer incorrect, allow one mark for $84 / 100 \times 312$ If answer not to whole number, allow 1 mark e.g. 262.08 gets one mark
	(f)	<p>ref to limited financial resources ;</p> <p>drugs are expensive ;</p> <p>long term commitment to treatment / AW ;</p> <p>ref to apportionment of resources ;</p> <p>ref to NICE ;</p>	2 max	<p><i>Answer must refer to problems with provision of treatment not problems with the drugs used for treatment</i></p> <p>e.g. 'NHS may not have enough money'</p> <p>DO NOT CREDIT 'drugs cost money'. Looking for the idea of a lot of money ACCEPT idea patients might live a long time DO NOT CREDIT 'long term treatment' as this is given in the question</p> <p>e.g. this might mean other treatments cannot be funded properly</p>
		Total	22	

PAPER TOTAL: 45

2866 Energy, Control and Reproduction

Question			Expected Answers	Marks
1	(a)	(i)	two or more, embryos / fetuses, growing in uterus (at same time) / AW ;	1
		(ii)	one (or more) fetuses may be naturally, aborted / miscarried ; one of a pair of twins may be reabsorbed into mother's body / vanishing twin syndrome ; AVP ; e.g. selective abortion	2 max
		(iii)	blood pressure reading taken ; very high blood pressure / AW ; sudden weight gain / swelling of hands and feet ; presence of protein in the urine ;	2 max
		(iv)	crown-rump length (of back) / biparietal diameter (of skull / cranium) ; R head circ A description	1
	(b)	(i)	increase in number of twin pregnancies ; total number of pregnancies also rises overall ; so apparent increase in number of twin pregnancies / AW, is less than suggested (by raw data) ; decrease in total number of pregnancies between 2000 and 2002 ; use of comparative figs. ; e.g. percentage increase in twin pregnancies is 9.97%	2 max
		(ii)	triplet pregnancies often due to, fertility treatments / IVF / named ; greater awareness of dangers of multiple pregnancies (from fertility treatment) / AW ; fewer embryos are now implanted (in e.g. IVF) / AW ; AVP ; e.g. reference to economic constraints of IVF e.g. regulations now in place governing number of embryos implanted	2 max
				[Total: 10]

Question			Expected Answers	Marks
2	(a)	(i)	easier to manoeuvre large machinery ; extra land used to grow crops / AW ; more income from extra productivity / produces higher yield ; less upkeep of hedges / AW ; AVP ; e.g. claim hedges harbour pests	2 max
		(ii)	loss of habitat ; A ora reduction in biodiversity / AW ; decrease in natural pest predators ; reduction in 'wildlife corridors' / AW ; reduction of, shelters / protection from predators ; increase in wind erosion / loss of topsoil ; promotes, leaching / run off, of nutrients ;	4 max
	(b)	(i)	<u>succession</u> ;	1
		(ii)	<i>CO₂ given at least once in answer to award mp3-7</i> broken down by, decomposers / named ; into, organic compounds / named ; <u>respiration</u> releases (carbon as) carbon dioxide ; carbon dioxide absorbed by trees ; during photosynthesis ; converted into, organic compounds / named ; used to build new cells ;	4 max
		(iii)	herb / perennial (community) not allowed to grow ; grazing / sheep eat grass ; deflected succession / succession, halted / AW ; plagioclimax ; pioneer community remains ; AVP ; e.g. correct ref to changes in soil pH due to animal faeces etc	3 max
				[Total: 14]

Question			Expected Answers	Marks		
4	(a)	(i)	<table><tr><td>stage of cell division</td><td>structure(s) formed</td></tr></table>	stage of cell division	structure(s) formed	3 max
stage of cell division	structure(s) formed					
		(ii)	carries, genetic information / DNA / AW, <u>for offspring</u> ; haploid / AW, to restore the chromosome number (at fertilisation) ; acrosome contains enzymes ; (enzymes) digest / hydrolyse, way into oocyte ; (middle piece) contains <u>many</u> mitochondria (for aerobic respiration) ; energy / ATP, for locomotion / AW ; microtubules / axial filament (in tail), for movement / AW ; AVP ; e.g. streamline shape, qualified	5 max		
		(iii)	attached to, developing / maturing, sperm / AW ; protects (developing) sperm ; nourishes (developing) sperm ; secrete fluid into lumen (of tubule) ; sensitive to testosterone concentration / AW ; aids, <u>regulation / control</u> , of spermatogenesis / AW ; AVP ; e.g. reabsorbs sperm cytoplasm / AW ; e.g. produces inhibin ;	3 max		
	(b)		<i>Assume reference to oogenesis if not qualified. Ignore refs. to spermatogenesis / named stages of meiosis</i> oogenesis begins, in embryo / before birth ; oogenesis is not a continuous process / AW ; (meiosis) in oogenesis does not complete until fertilisation / AW ; only one, ovum / secondary oocyte / gamete, is produced in oogenesis ; (two) polar bodies produced in oogenesis ;	2 max		
	(c)		<i>Testosterone</i> cell membrane contains phospholipids ; (testosterone) dissolves in phospholipids ; <i>ISCH or LH</i> molecule too big to go through membrane ; (glycoprotein) is not lipid soluble ;	3 max		

Question Expected Answers**Marks**

5 (a) (i) ventral ;

1

- (ii) *Mark each cell as stand alone cell*
Only mark first given function if candidate provides a list

	name of structure of brain	function of structure
A	cerebral hemisphere / cerebrum / cerebral cortex ;	speech emotion personality sensory input motor response association centres any accurate named function
B	medulla (oblongata) ;	coordinates involuntary movement named e.g. of involuntary movement life support systems named e.g. of life support system
C	cerebellum ;	controls movement posture balance coordination fine movement eye movement

6

(b) (i) neurotransmitter ;

1

- (ii) (normally) dopamine keeps acetylcholine at normal level / AW ;
 as dopamine production drops too much acetylcholine at synapse / AW ;
 too much stimulation of, motor nerves / muscles (to produce tremor) ;
 without dopamine so much acetylcholine, that post synaptic membrane
 depolarised permanently / AW ;
 so cannot transmit impulse ;
 muscle(s), tetanus / become fatigued ;

2 max

- (iii) (dopamine in the form of) Levodopa[®] used ;
A dopamine, replacement / mimicking drugs
 dopamine will not cross / Levodopa[®] will cross, blood brain barrier ;
 molecule, too big / small enough ;
 Levodopa[®] (easily) converted to dopamine ;
 AVP ; e.g. enables smooth muscle movements
 e.g. long term treatment required / ora
 e.g. side effects / named e.g., combated with other drugs / AW
 e.g. using anticholinergic drugs

2 max

Question		Expected Answers	Marks
5	(c)	<p><i>Accept annotations on diagram</i></p> <p>1 (arrival of action potential) depolarises presynaptic <u>membrane</u> ;</p> <p>2 sodium channels open ;</p> <p>3 sodium ions move into, synaptic knob / presynaptic membrane ;</p> <p>4 calcium channels open ; R incorrect ion notation</p> <p>5 e.g. Ca⁺</p> <p>6 calcium ions move in (to synaptic knob) ;</p> <p>7 vesicles containing, ACh / acetylcholine / neurotransmitter ;</p> <p>8 move to / fuse with presynaptic membrane ;</p> <p>9 release contents into synaptic cleft ;</p> <p>10 diffuse across cleft ;</p> <p>11 ACh / neurotransmitter binds to protein receptors ;</p> <p>12 on postsynaptic membrane ;</p> <p>13 changes shape of protein ;</p> <p>14 causes sodium channels to open ;</p> <p>15 influx of sodium ions into cytoplasm of postsynaptic membrane / AW ;</p> <p>depolarises postsynaptic <u>membrane</u> ;</p> <p>16 AVP ; e.g. ref to recycling of neurotransmitter / acetylcholinesterase</p>	7 max
		<p>QWC – clear well organised using specialist terms;</p> <p><i>At least 3 of the terms shown in bold: depolarise, calcium ion / Ca²⁺, vesicles, acetylcholine, neurotransmitter, fuse, synaptic cleft, diffuse, protein receptors, sodium ion / Na⁺.</i></p>	1
			[Total: 20]

Question		Expected Answers		Marks								
6	(a)	1 many mitochondria ; 2 for <u>high</u> ATP production ; 3 glycogen store ; 4 myoglobin (pigments) ; 5 higher affinity, for oxygen, than haemoglobin ; 6 good blood supply / large number of capillaries; 7 high level of glycolytic enzymes (for fast-twitch fibres) ; 8 AVP ; e.g. high tolerance to lactic acid e.g. creatine phosphate	R refs. to, producing / creating, energy	4 max								
	(b)	(i)	circulatory system does not have enough time to deliver oxygen / AW ;	1								
		(ii)	lactate ; A lactic acid	1								
		(iii)	glycolysis provide a net gain of 2 ATP ; ref. to link reaction / Krebs cycle / oxidative phoshorylation ; overall net gain is 32 ATP (per molecule of glucose) ;	2 max								
	(c)	(i)	<table><tr><th>statement</th><th>true (✓) or false (✕)</th></tr><tr><td>contains glycosidic bonds</td><td>✕ ;</td></tr><tr><td>has a tertiary structure</td><td>✓ ;</td></tr><tr><td>has a double helix</td><td>✕ ;</td></tr></table>	statement	true (✓) or false (✕)	contains glycosidic bonds	✕ ;	has a tertiary structure	✓ ;	has a double helix	✕ ;	3
statement	true (✓) or false (✕)											
contains glycosidic bonds	✕ ;											
has a tertiary structure	✓ ;											
has a double helix	✕ ;											
		(ii)	<i>coronary arteries given at least once in answer to award mp1 & 6</i> R references to break down of existing plaques prevents / slows formation of plaques in <u>coronary arteries</u> ; where artery <u>wall</u> is damaged / AW ; cholesterol / lipids, are not deposited ; lymphocytes / macrophages, do not collect ; cells do not multiply in wall ; no blockage / AW, of artery ; maintains, oxygen / glucose, supply to heart <u>muscle</u> ;	3 max								
	(d)	(i)	exercise increases endostatin concentration ; for (at least) 2 hours / data shows peak at 2 hours ; between 2 and 6 hours the concentration of endostatin decreases ; 6 hours after exercise has stopped, concentration of endostatin is still higher than before exercise ; accurate ref to error bars ; accurate ref to, gaps in data / appropriate range ; comparative figs to illustrate, both axes ;	3 max								

Question			Expected Answers	Marks
6	(d)	(ii)	genetic mutation / natural variation between individuals ; selective advantage / AW ; less likely to develop CHD / AW ; survived to reproduce ; passed characteristic on to offspring ; AVP ; e.g. increase allele frequency in gene pool A ora	3 max
				[Total: 20]

PAPER TOTAL: 90

2867 Genetics, Homeostasis and Ageing

Question			Expected Answers	Marks
1	(a)	(i)	the removal of waste products of, metabolism / chemical reactions of the body ;	1
		(ii)	urea ; uric acid ; creatinine ; (excess) water ; (excess) ions ;	2 max
		(iii)	dissolves in water to form carbonic acid ; (carbonic acid) dissociates to form hydrogen ions / $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}^+$ (this) increases the acidity of the blood / <u>lowers</u> pH ; ref to carbonic anhydrase ; low pH, reduces / slows, enzyme activity ; if CO ₂ levels are, too high / above 16 kPa / 120mm Hg ; may, increase breathing rate / become unconscious ;	3 max

Question		Expected Answers	Marks
1	(b)	<p>1 mark for named change, 3 max for explanation</p> <p>glucose present ;</p> <p>diabetes ; concentration of glucose in the blood too high ; exceeds renal threshold / described ;</p> <p>OR</p> <p>protein present ;</p> <p>hypertension ; kidney damage / glomerular damage / basement membrane damage ; allowing, larger molecules / molecules with RMM of more than 65 000, through ;</p> <p>OR</p> <p>excess water / (large volume of) dilute urine ;</p> <p>diabetes insipidus ; damage to hypothalamus ; too little ADH ; collecting ducts, reabsorb less water / become less permeable ; cannot produce aquaporins ; A fewer aquaporins</p> <p>OR</p> <p>Blood (cells) present ;</p> <p>kidney / urinary tract, infection (UTI) ; kidney / urinary tract / bladder / prostate, cancer ; damage to, nephron / tubule ;</p> <p>OR</p> <p>haemoglobin present ;</p> <p>malaria / blood cancer ; damaged erythrocytes ; haemolysis ;</p> <p>AVP (change) ; (explanation) ; ;</p>	6 max

Question	Expected Answers	Marks
1 (c) (i)	a test which, identifies / detects / diagnoses, disease / condition / cancer ; a test which gives high probability of, disease / condition / cancer ;	1 max
(ii)	59% of / some, cancers may go undetected ; could generate false positives / test not reliable ; could cause unnecessary worry / false reassurance / AW ; qualified ref to ethics of using an animal in this way ;	2 max
		[Total: 15]

Question		Expected Answers		Marks											
2	(a)	ductless gland ; secretes / produces, hormones ; (secretes) directly into blood ;		2 max											
	(b)	<i>mark complete rows for a comparative statement accept AW throughout</i> <table><tr><th>nervous system</th><th>endocrine system</th></tr><tr><td>electrical / electrochemical / impulses / action potentials</td><td>chemical / hormone</td></tr><tr><td>along, neurone / axon / nerve fibre</td><td>carried in blood</td></tr><tr><td>rapid / immediate (response)</td><td>slower (response)</td></tr><tr><td>short lived (response)</td><td>longer lasting (response)</td></tr></table>		nervous system	endocrine system	electrical / electrochemical / impulses / action potentials	chemical / hormone	along, neurone / axon / nerve fibre	carried in blood	rapid / immediate (response)	slower (response)	short lived (response)	longer lasting (response)	; ; ; ; ;	3 max
nervous system	endocrine system														
electrical / electrochemical / impulses / action potentials	chemical / hormone														
along, neurone / axon / nerve fibre	carried in blood														
rapid / immediate (response)	slower (response)														
short lived (response)	longer lasting (response)														
	(c)	fluid, surrounding / bathing, internal, organs / tissues / cells ; ref. to, controlled / homeostatic, environment ;		1 max											
	(d) (i)	<i>nervous system</i> <i>internal</i> water potential of <u>blood</u> / <u>blood</u> pH / concentration of, O ₂ / CO ₂ / AVP ; <i>external</i> light / sound / touch / temperature / AVP ;		2 max											
	(ii)	<i>endocrine system</i> <i>internal</i> concentration of <u>blood</u> glucose / water potential of <u>blood</u> / AVP ; <i>external</i> temperature / day length / stress stimuli / emotional stimuli / AVP ;		2 max											
	(e)	<i>first dose</i> little insulin in blood (so blood glucose concentration rises) ; little, conversion to glycogen / absorption by, liver / muscle (cells) ; <i>subsequent doses</i> glucose detected by, islets of Langerhans / (cells in) pancreas ; <u>beta</u> cells secrete insulin ; (so) blood glucose concentration drops ; (increased), conversion to glycogen / absorption by, liver / muscle (cells) ; (with subsequent doses) more immediate <u>effect</u> of insulin ; (because) concentration of insulin continues to rise ;		4 max											
				[Total: 14]											

Question			Expected Answers	Marks
3	(a)	(i)	<u>non-disjunction</u> ;	1
		(ii)	<p><i>A points from a diagram if clear</i> some of the cells (produced from meiosis I) will have two chromosome 21's ; <i>A ora</i> male gamete has one chromosome 21 ; after fertilisation, three chromosome 21's ;</p>	2 max
	(b)	(i)	<p>344.44 ; ;</p> <p><i>if answer incorrect allow one mark for:</i> $\frac{0.62}{0.18} \times 100$;</p> <p>OR $\frac{0.80 - 0.18}{0.18} \times 100$;</p> <p><i>if answer correct but not to two decimal places allow one mark for:</i> 344.4 ; OR 344.444 ; OR 344 ;</p>	2 max
		(ii)	as maternal age increases the incidence increases / <u>positive</u> correlation ; over age 40 (years) there is a large increase in incidence of Down's syndrome / AW; comparative figs in support using both columns ;	2
		(iii)	<p><i>mother</i> oocytes / gametes, do not complete meiosis until fertilisation ; mutation more likely in older cells ; oocytes are older and more exposed to pollutants / AW ;</p> <p><i>father</i> sperm / male gametes, produced continuously ; (sperm development) not held in meiosis ; defective gametes do not compete well at fertilisation / AW ;</p>	3 max
	(c)		<u>translocation</u> ; part of (the long arm of) chromosome 21 breaks off ; attaches to another chromosome ; (attaches to) chromosome, 21 / 14 ; zygote has 2 chromosome 21's plus translocated section ; chromosome number is normal ; AVP ; e.g. this form of Down's syndrome may be inherited	3 max

Question			Expected Answers	Marks
4	(a)	(i)	in neck / either side of trachea above, larynx / voice box ; R in throat	1
		(ii)	<p>(iodide) ions are soluble ;</p> <p>(facilitated) diffusion from blood ; <u>down</u> concentration gradient ; through, <u>protein</u> channels / transport <u>proteins</u> (in cell membranes) ; R carrier proteins</p> <p>OR</p> <p>active transport ; against concentration gradient / requires ATP ; ref. to protein pump / transport / carrier, <u>proteins</u> (in cell membranes) ; R protein channels</p>	3 max
	(b)		<p>A iodine / sodium iodide / ¹³¹I as synonyms throughout</p> <p>D1 A takes up iodine <u>rapidly</u> ; D2 (upto) 60% after 6 hours / AW ; D3 (after 6 hours) rate decreases ; D4 B takes up iodine at steady rate ; D5 (upto) 25% after 24 hours / AW ; D6 C takes up iodine slowly ; D7 (upto) 10% at 15 hours / AW ; D8 correct ref. to final figure at 48 hours for, A / B / C ;</p> <p>5 max</p> <p>E1 A has, over-active thyroid / hyperthyroidism ; E2 subjected to cold (environmental) temperatures over a few days / AW ; E3 more iodine is taken up / less iodine excreted ; E4 (A has) too much / a lot of, thyroxine made ; E5 B has normal thyroid / AW ; E6 C has, under-active thyroid / hypothyroidism / myxoedematous ; E7 less iodine taken up / more iodine excreted ; E8 (C has) little thyroxine made ;</p> <p>5 max</p>	8 max
			QWC - legible text with accurate spelling, punctuation and grammar; Candidates should have no more than three different spelling errors, sentences should be accurately punctuated according to spoken English and text should be legible.	1

Question			Expected Answers	Marks
4	(c)	(i)	thermogenesis ; thyroxine increases, metabolic rate / rate of respiration ; increased metabolism of, fat / glucose ; (more) thermal energy / heat, is released ; ref. to uncoupling ; AVP ; detail e.g. increase in number of mitochondria e.g. increases, respiratory enzymes / enzymes of electron transport chain e.g. increases, transcription / described	3 max
		(ii)	takes time for metabolism to respond to the effect of thyroxine / AW ;	1
				[Total: 17]

Question			Expected Answers	Marks
5	(a)	(i)	<p><i>osteoporosis</i> A, B, D (in any order) ;</p> <p><i>osteoarthritis</i> F, E, G (in any order) ;</p>	2
		(ii)	<p>N do not smoke (given in (a)(i))</p> <p>adequate intake of calcium ; adequate vitamin D ; named (dietary) sources of, calcium / vitamin D ; take regular exercise ; ensure load bearing exercise ; do not over-exercise joints / avoid high impact on joints / avoid injury to joints ; avoid excessive weight gain ;</p>	4 max
	(b)	(i)	<p>1 lining of joint / proteins / collagen, recognised as, antigen / foreign ; 2 engulfed by macrophages / phagocytosis ; 3 (antigens) incorporated into cell surface membrane / Antigen Presenting Cell forms ;</p> <p>4 B lymphocytes, recognise / bind to, antigens (on APC) ; 5 clonal, selection / expansion, to produce plasma cells ; 6 (plasma cells) secrete antibodies ;</p> <p>7 T lymphocytes, recognise / bind to, antigens (on APC) ; 8 clonal, selection / expansion, to produce, T killer / T helper / cytotoxic T, cells ; 9 T helper cells secrete cytokines ;</p> <p>10 Antibodies / cytokines / T killer cells, destroy joint lining ;</p>	5 max
		(ii)	<p><u>cartilage</u> / <u>synovial membrane</u>, destroyed ; bone surfaces (of joint) exposed / increased friction / AW ; swelling (of joint) / pain ; accumulation of, <u>synovial</u> / <u>tissue</u>, fluid ; AVP ; detail e.g. release of histamine</p>	2 max
		(iii)	<p>mutation ; receptors on, B / T, lymphocytes (to self-antigens) are not destroyed / AW ; (because) immune system may not mature fast enough ;</p> <p>immune system less accurate as age increases / AW ;</p>	2 max

Question			Expected Answers	Marks
6	(a)	(i)	C ;	1
		(ii)	protein ;	1
		(iii)	(genetic code is) the sequence of bases in DNA ; determines sequence of amino acids in, polypeptide / protein (K ⁺ ion channel) ; triplet / three bases, form(s) codon ; specific code for each amino acid / AW ; AVP ; detail e.g. ref. to, translation / transcription	3 max
		(iv)	potassium ions / K ⁺ , cannot pass <u>out</u> (of neurone) ; by (facilitated) <u>diffusion</u> ; down, electrochemical gradient / AW ; neurone not repolarised ; (therefore) no new action potentials / AW ;	4 max
	(b)		P1 it is always expressed in phenotype ; P2 there are no carriers for a dominant allele ; P3 does not skip a generation / AW ; P4 affected person may be, homozygous / heterozygous (for the allele) ; P5 no sex bias / not sex-linked / AW ; P6 if one parent heterozygous for allele, 0.5 / 50% chance of offspring inheriting dominant phenotype / AW ; P7 if one / both parent homozygous for allele, 1.0 / 100% chance of offspring inheriting dominant phenotype / AW ; P8 if both parents heterozygous for allele, 0.75 / 75% chance of offspring inheriting dominant phenotype / AW ; 5 max T1 genetic test to determine whether father is heterozygous or homozygous ; T2 (inform) probability of offspring inheriting condition / AW ; T3 IVF / in vitro fertilisation ; T4 genetic screening of embryo for mutated allele ; T5 AID / artificial insemination by donor ; 4 max	7 max
			QWC - clear, well organised using specialist terms ; At least 3 of the terms shown in bold: homozygous, heterozygous, expressed, phenotype, IVF, in vitro fertilisation, AID, artificial insemination (by donor), genetic screening, carrier, sex bias, sex-linked	1

Question			Expected Answers	Marks
6	(c)	(i)	A / adenine ; R adenosine	1
		(ii)	G / guanine ;	1
		(iii)	<p>frame shift ;</p> <p>deletions mean that the, <u>triplet</u> / <u>codon</u>, is one base short ;</p> <p>all subsequent codons affected / AW ;</p> <p>may not, form protein / fold protein correctly / AW ;</p> <p>substitution only changes one codon / AW ;</p> <p>(may) change one amino acid / have silent mutation ;</p>	3 max
				[Total: 22]

Question			Expected Answers	Marks
7	(a)	(i)	35 year old has a low number of, incomplete / anovular, cycles ; 35 year old has similar number of incomplete <u>and</u> anovular cycles ; 35 year old has large number of normal cycles ; 50 year old has, more incomplete than normal cycles / fewer anovular than normal cycles ; 50 year old has fewer normal cycles compared with 35 year old ; 50 year old has more, incomplete / anovular, cycles than 35 year old ; comparative figs both axes to illustrate ;	4 max
		(ii)	<i>change brought about by</i> menopause / peri-menopause ; ovaries less sensitive to FSH ; follicles do not mature ; less oestrogen (secreted) ; no oestrogen surge so no ovulation ; loss of hormone balance ;	4 max
		(iii)	(no oocytes so) no oestrogen ; oestrogen, inhibits / is antagonistic to, parathormone ; parathormone mobilises bone calcium / AW ; (so) bones lose mass / bones more likely to fracture ; AVP ; detail e.g. osteoclast activity	2 max
		(iv)	less <u>progesterone</u> released ; <u>endometrium</u> will not be maintained ; (endometrium) has too few blood vessels / not thick / not spongy ; not suitable for implantation of embryo / AW ; (can lead to) infertility ;	3 max
	(b)		demands (on the body) of child bearing as body ages ; may reduce survival chances of, mother / baby ; mutations less likely during gamete production (with shortened reproductive span) ; natural selection ; selection pressure favours alleles that decrease ovulation after 35 years of age ;	3 max
	(c)		risks associated with pregnancy ; increased chance of harmful mutation(s) may affect foetus ; dividing reproductive cells may become cancerous / AW ; increased risk of, breast / uterine / ovarian, cancer / CVD ; re-starting menstrual cycle may be debilitating / AW ;	2 max
				[Total: 18]

PAPER TOTAL: 120

Grade Thresholds

Advanced GCE Human Biology (7886)
Advanced Subsidiary GCE Human Biology (3886)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2856	Raw	60	43	38	33	28	23	0
	UMS	90	72	63	54	45	36	0
2857	Raw	60	45	40	35	30	25	0
	UMS	90	72	63	54	45	36	0
2858/A	Raw	120	94	82	71	60	49	0
	UMS	120	96	84	72	60	48	0
2858/B	Raw	120	94	82	71	60	49	0
	UMS	120	96	84	72	60	48	0
2866	Raw	90	64	56	48	40	32	0
	UMS	90	72	63	54	45	36	0
2867	Raw	120	78	69	60	51	42	0
	UMS	120	96	84	72	60	48	0
2868	Raw	90	74	66	58	50	42	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3886	300	240	210	180	150	120	0
7886	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
3886	6.1	19.4	43.0	74.1	93.5	100.0	264
7886	6.7	22.1	45.5	72.9	93.3	100.0	951

1215 candidates aggregated this series

For a description of how UMS marks are calculated see:

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