

Human Biology

Advanced GCE A2 7886

Advanced Subsidiary GCE AS 3886

Mark Schemes for the Units

January 2008

3886/7886/MS/R/08J

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Advanced GCE Human Biology (7886)

Advanced Subsidiary GCE Human Biology (3886)

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2856 Blood, Circulation and Gaseous Exchange

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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	A	= accept
ora	= or reverse argument	

Question	Expected Answers	Marks
1		
(a)	(i) E ; D ;	2
	(ii) F ; F ; B / D ;	3 max
(b)	(i) (a) muscle / named muscle ; liver ;	2
	(ii) made of many glucoses / polysaccharide ; (highly) branched / many free, ends / terminals ; <u>easily</u> broken down / hydrolysed, (to release glucose) ; compact ; large amount can fit into a small space / AW ; AVP ; eg many sites for enzyme attachment reversibility glucoses can be added or taken off	3 max

[Total:10]

Question	Expected Answers	Marks
2		
(a)	(i)	
	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="border: 1px solid black; padding: 2px 10px;">prothrombin ;</div> <div style="border: 1px solid black; padding: 2px 10px; background-color: #e0e0e0;">enzyme Y</div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 10px;">fibrinogen ;</div> <div style="border: 1px solid black; padding: 2px 10px;">fibrin ;</div> </div> <p style="margin-left: 40px;"><i>allow phonetic spellings</i></p>	3
	(ii)	
	<div style="display: flex; justify-content: space-between;"> <div>calcium (ions) / Ca^{2+} / Ca^{++} ;</div> <div style="text-align: right;"><i>allow Ca</i> R Ca^+ / incorrect ion</div> </div>	1
(b)	<p>Z is similar in shape to normal substrate ; R same acts as a <u>competitive</u> inhibitor ; (it) fits into active site ; <i>goes in / binds ok</i> blocks active site / prevent substrate entering / no ES complex ; reduces <u>rate of reaction</u> / AW ; AVP ; eg ref. to reversible / irreversible / temporary / permanent correct ref. to non-competitive inhibition</p>	4 max [Total: 8]

Question	Expected Answers	Marks
3		
(a)	<p>1 qualified ref. to named risk factor eg diet high in saturated fat / high salt diet / hypertension ;</p> <p>2 deposits, under/in, endothelium ; <i>accept artery wall</i></p> <p>3 of, LDL / cholesterol ;</p> <p>4 decreases lumen of artery ;</p> <p>5 (this) increases blood pressure ;</p> <p>6 release of blood clotting factors / activation of platelets ;</p> <p>7 caused by, tears in endothelium / rough surfaces (of endothelium) / turbulent blood flow / damage to artery <u>wall</u> ;</p> <p>8 (static) clot / thrombus, forms (on endothelium) ;</p> <p>9 clot dislodged / embolus ;</p> <p>10 clot, lodges in / AW, <u>coronary artery</u> ;</p> <p style="text-align: right;"><i>6 max marking points 2-10</i></p> <p>11 reduces blood supply to area of, <u>heart muscle</u> / <u>heart tissue</u> ;</p> <p>12 reduces, oxygen / glucose, delivery to area of <u>heart muscle</u> / <u>heart tissue</u> ;</p> <p>13 death of <u>heart muscle</u> / <u>heart tissue</u> ;</p> <p>14 AVP ; eg correct ref. to foam cells calcification of atheroma correct ref. to fibrous tissue correct ref. to atherosclerosis reduces elasticity of artery</p>	8 max
	<p>QWC legible text, spelling, punctuation and grammar ; <i>no more than three different spelling errors</i></p>	1
(b)	<p>open heart surgery / heart-lung bypass machine / ICU care required ; <u>vein</u> from leg ; <i>ignore ref. to artery or other blood vessels</i> attached to aorta ; attached to coronary artery, beyond blockage / AW ; AVP ; eg artery from, chest / arm</p>	3 max
	<p><i>Blood vessels commonly used</i></p> <ul style="list-style-type: none"> • <i>left internal thoracic artery (LITA) (previously referred to as left internal mammary artery or LIMA)</i> • <i>right internal thoracic artery (RITA)</i> • <i>great saphenous vein from the leg</i> • <i>radial artery from the forearm</i> 	
		[Total: 12]

Question	Expected Answers	Marks
4		
(a)	(i) P surfactant / moisture film ; Q Golgi body ; R RER ;	3
	(ii) 15 000 ;; <i>one mark for</i> measurement of scale bar ÷ 1 eg 1.5 ÷ 1 / 15 ÷ 1 / 15 000 ÷ 1	2 max
(b)	<i>feature identified</i> thin / flat / large SA ; <i>linked explanation</i> short <u>diffusion</u> distance / high rate of <u>diffusion</u> ;	2 max
(c)	no cell walls ; no vacuoles ; no chloroplasts ;	2 max
		[Total: 9]

Question	Expected Answers	Marks
5		
(a)	(lung) cancer ; COPD ; emphysema ; bronchitis ; asthma ; alveolitus ; bronchiolitus ; pneumonia ;	2 max
(b)	asthma ;	1
(c)	persistent coughing ; productive cough / coughing up blood ; fever / chills / night sweats ; appetite loss / weight loss ; AVP ; eg flushed cheeks	3 max
(d)	(i) FEV ₁ ; the maximum rate at which air can be expelled from the lungs / AW ; the volume of air that can be forced out of the lungs after a maximal inhalation / TV+IRV+ERV / total amount you can move in and out of the lungs <u>in one breath</u> ;	3
	(ii) build up of scar tissue / tubercles ; loss of elasticity ; reduced elastic recoil ; muscular weakness ; ref. to intercostal muscles ; AVP ;	2 max
		[Total: 11]

Question	Expected Answers	Marks
6		
(a)	<p>arranged in a bilayer ; heads pointing out / tails pointing in ; correct ref. to hydrophilic / hydrophobic ;</p> <p><i>credit correct marking points from diagrams</i></p>	2 max
(b)	<p>1 water potential, less negative / greater, outside the cell than inside ; 2 movement of water <u>in</u> (to the cell) ; R incorrect method of movement 3 by osmosis ; 4 down a water <u>potential</u> gradient ; 5 causing the cell to, swell / burst / lyse ;</p> <p><i>concentration of treat as neutral</i></p>	4 max
(c)	<p>(i) (oxygen taken up by) diffusion ; greater, concentration / diffusion, gradient ;</p> <p>(ii) (transported through) intrinsic / transporter / carrier, proteins ; 1st part of the curve as external concentration of glucose goes up rate of uptake increases / AW ; more glucose molecules, more protein carriers occupied ; constant part of the curve all protein carriers working at full capacity ; AVP ;</p>	2 2 max
		[Total: 10]

2857 Growth, Development and Disease

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Question	Expected Answers	Marks										
1 (a) (i)	8 ; ; 2/24 X 100 ;	2 max										
(ii)	<table border="1"> <thead> <tr> <th>process</th> <th>stage</th> </tr> </thead> <tbody> <tr> <td>new cellular proteins are synthesised</td> <td>interphase ;</td> </tr> <tr> <td>cytoplasm separates into two cells</td> <td>cytokinesis ;</td> </tr> <tr> <td>DNA replicates</td> <td>interphase ;</td> </tr> <tr> <td>DNA separates to form two nuclei</td> <td>mitosis ;</td> </tr> </tbody> </table>	process	stage	new cellular proteins are synthesised	interphase ;	cytoplasm separates into two cells	cytokinesis ;	DNA replicates	interphase ;	DNA separates to form two nuclei	mitosis ;	4
process	stage											
new cellular proteins are synthesised	interphase ;											
cytoplasm separates into two cells	cytokinesis ;											
DNA replicates	interphase ;											
DNA separates to form two nuclei	mitosis ;											
(b) (i)	meiosis ;	1										
(ii)	produces <u>haploid</u> cells ; with half the normal number of chromosomes / n / 23 ; to maintain the diploid number / 2n / 46 ; after fertilisation ; ref. to <u>genetic</u> variation ;	4 max										

[Total: 11]

Question	Expected Answers	Marks
2 (a) (i)	<p>incidence has increased ; mortality stays the same until 1988 ; mortality decreases slightly after 1988 ; incidence much higher than mortality ; difference between incidence and mortality has widened / AW ; pairs of, comparative figures in support ; ecf for units if used incorrectly a second time</p>	<p>A 87-89 A 87-89</p> <p>3 max</p>
(ii)	<p>lifestyle changes qualified, have resulted in an increase in new cases ; improved diagnostic techniques detect, more cases / at an earlier stage ; health awareness campaigns effective / more women screened ; cancer more likely to be successfully treated if detected at an early stage ; more successful treatments available ; more women living for longer ;</p>	2 max
(b) (i)	<p>breast cancer in the family / AW ; early puberty / late menopause ; post menopausal ; fewer / no, children ; not breast feeding ; being female ; contraceptive pill ; HRT ; obesity ; heavy alcohol intake ; age ; AVP ; X-ray / gamma radiation of <u>breast</u> / have had breast cancer before</p>	2 max
(ii)	<p>lumpectomy described ; mastectomy described ; removal of lymph nodes ; 2 max</p> <p>named drug / Tamoxifen® ; drugs given intravenously ; kill, rapidly dividing cells / cancer cells ;</p> <p>AVP ;</p>	3 max
		[Total: 10]

Question	Expected Answers	Marks
3 (a)		

nutrient	role in growth of embryo and foetus
carbohydrates	provide energy (for anabolic processes) ;
vitamin A	for production of, visual pigments / named visual pigment / healthy skin / mucous membranes ;
folic acid	for, growth / development, of brain / spinal cord / neural tube ;
amino acids	for production of, proteins / named protein ;

4

- (b) ultrasound ;
description of how ultrasound is used ;
crown – rump length ;
biparietal diameter ;

2 max

- (c) (alcohol) crosses the placenta / from mother's blood into foetus' blood ;
foetal alcohol syndrome / FAS, described ;
affects development of nervous system / AW ; **R mental retardation**
undernourishment / low birth weight ;
smaller than normal head circumference ;
heart defects ;
AVP ; eg miscarriage / premature birth

3 max

- (d) culturing detail described ;
add, chemical / colchicine to stop cell dividing;
at metaphase ;
put in dilute salt solution to burst cell and spread chromosomes ;
chromosomes arranged in homologous pairs to form karyotype ;
XXY / described ;
AVP ;

4 max

[Total: 13]

Question	Expected Answers	Marks
4	<p>(a) antigen ; <u>specific</u> response ; (specific) antibodies made ; correct ref. to, T / B cells ;</p>	2 max
	<p>(b) <i>in order:</i> macrophages ; antigens ; receptors ; mitosis ; clones ; cytokines ;</p>	6
	<p>(c) <i>killer T cells / B cells</i></p> <ol style="list-style-type: none"> 1 clonal selection / described ; 2 clonal expansion / mitosis / described ; 3 become memory cells ; 4 correct ref. to complementary ; <p><i>B cells</i></p> <ol style="list-style-type: none"> 5 differentiate ; 6 plasma cells ; 7 make antibodies ; 8 attach to specific antigen ; 9 action of antibodies described ; <p style="text-align: right; margin-right: 20px;">3 max</p> <p><i>T cells</i></p> <ol style="list-style-type: none"> 10 respond to viruses ; 11 bind to receptors ; 12 on surface of infected cells ; 13 inject cell with toxic chemical / named ; 14 kills cell ; <p style="text-align: right; margin-right: 20px;">3 max</p> <ol style="list-style-type: none"> 15 AVP ; eg correct ref. to humoral / cell mediated response 16 AVP ; eg faster secondary response 	7 max
	<p>QWC – clear well organised using 3 specialist terms;</p>	1
	<p><i>clonal selection, clonal expansion, memory cells, differentiate, plasma cells,, complementary, humoral, cell mediated, hydrogen peroxide, secondary response, primary response</i></p>	

[Total: 16]

Question	Expected Answers	Marks
5 (a) (i)	<p><i>for Africa or ora</i> malnourishment / protein energy malnutrition (PEM) ; weakened immune system ; ref. to HIV ;</p> <p>antibiotics / drugs / vaccination not readily available ; not enough hospitals / doctors / health clinics ;</p> <p>don't complete drug treatment ; don't go to be diagnosed / treated ; more people with active TB in community / AW ; more people in crowded living conditions ; AVP ; qualified reference to economic status</p>	3 max
(b)	<p>required by law / compulsory ; to be reported to appropriate authority / medical officer for health ; information required qualified ;</p>	2 max
(c)	<p>1 bacteria show (genetic) variation in resistance to antibiotics / AW ; 2 as a result of mutation / described ; 3 during DNA replication ; R mitosis 4 when given, antibiotic acts as selection pressure ;</p> <p>5 bacteria with gene for resistance to antibiotic more likely to survive / AW ; ora 6 resistant bacteria, divide / multiply ; ora 7 gene for resistance passed on to offspring ; 8 give rise to a resistant population of the bacteria ; 9 AVP ; role of plasmids / horizontal transmission described</p>	5 max
		[Total: 10]

2858/01 Case Studies

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1 (a) (i)	hydrogen (bond) ;	1
(ii)	<p><i>double stranded</i> (for) replication / AW ; semi-conservative(ly) ;</p> <p><i>four bases</i> ref triplet code ; large amounts of information carried / AW ; degenerate code ;</p> <p>information can be copied, accurately / template ; ref complementary base pairing ;</p> <p>AVP ;; eg stable due to (large numbers of) hydrogen bonds eg number of hydrogen bonds</p>	4 max
(b)	<p>1 complementary base pairing, described ; <i>mRNA/DNA or tRNA/mRNA</i> 2 (mRNA) carries (complementary) copy of gene/AW ; <i>section of DNA coding for primary sequence</i></p> <p><i>transcription</i></p> <p>3 mRNA, <u>nucleotides</u> (pair up) ; 4 (moves to) to ribosome ; 5 ribosome (made of) RNA ; 6 (ribosome is) framework for mRNA, (and) two, tRNA molecules ;</p> <p><i>translation</i></p> <p>7 (tRNA) brings amino acid to ribosome ; 8 ref specificity of tRNA molecules / AW ; 9 ref anticodon ; 10 ref formation of, peptide bond ; 11 ref stop/start/initiation / termination codon ; 12 AVP ; eg polyribosomes / AW 13 AVP ; eg (mRNA) leaves nucleus / AW</p>	7 max

- (c) (i) base/nucleotide, substitution ;
(produces) different triplet / codon ;
different amino acid ;
- base/nucleotide, deletion ;
base/nucleotide, addition ;
ref frameshift mutations / described ;
AVP ; **3 max**
- (ii) ref (mutation in) proto-oncogenes ;
ref (mutation in) repressor genes ;
ref oncogenes ;
ref uncontrolled, cell division ;
AVP ; eg (UV leads to) formation of tumours **3 max**
- (d) (i) (overall) rise ;
figures to support ; 2x and 2 y refs with units
AVP ; eg reference to any rise or fall within the time period **2 max**
- (ii) *accept reverse argument throughout*
- (men) less likely to use sun creams / AW ;
(men) more likely to work outdoors / AW ;
AVP ; eg women wear UV protection make-up **1 max**
- (iii) allows comparisons (between different population sizes) ;
number (of cases) smaller ; **1 max**
easier to plot ;

[Total: 22]

Question	Expected Answers	Marks
2 (a)	active transport ; ATP ; kinetic ; diffusion ; higher / greater / more ;	5
(b) (i)	sudden onset / AW ;	1
(ii)	high(er) breathing rate / AW ; shallow breathing rate / AW ; AVP ; eg nasal flaring	1 max
(iii)	<i>assume candidate is talking about respiratory arrest unless otherwise indicated</i> breathing, stops / not noticeable / (very) low rate ;	1
(iv)	choking / AW ; cardiac arrest ; brain damage ; myocardial infarction ; AVP ; eg drowning AVP ; eg sleep apnoea	1 max
(c)	<i>accept ORA throughout</i> not red blood cells ; not , A / B / Rhesus , antigen ; (recipients plasma) antibody not always present ; (leucocyte agglutination involves) recipients cells ; AVP ; eg ref isoantibody, agglutininogen, agglutiniogen	2 max
(d) (i)	<i>R syphilis, leukaemia, CMV</i> HIV / AIDS ; Hepatitis ; AVP ;	1 max
(ii)	who is allowed access to results / AW ; possibility of discrimination, by named group ; false positives ; AVP ; eg encourage people to change ID	2 max
(e)	(platelets) collect / AW, at wound site ; become sticky / activated ; (form a) platelet plug ; (platelets disintegrate) release of, clotting factor ; ref thromboplastinogenase ; ref platelet factor 3 ; thromboplastin, formed / AW ; AVP ; eg role of thromboplastin / ref clotting cascade / role of calcium ions / role of ADP / thromboxane	4 max

- (f) (i) cells burst ; allow ref to burst cells in (i) or (ii)
- blood contains cells / AW ; ORA
(due to) ice crystals form ;
low temperature reduces / AW, metabolic / AW activity ;
- (ii) (mannitol) lowers water potential ;
(water potential) same as (cell) cytoplasm ; **A** isotonic
ref osmosis ;
mannitol, not metabolised / AW ;
- (iii) ref (aerobic) respiration ;
ref diffusion ;
(of) oxygen / carbon dioxide ;
AVP ; eg metabolically active

5 max

[Total: 23]

2866 Energy, Control and Reproduction

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Question	Expected Answers	Marks
1 (a) (i)	choroid ; <u>aqueous</u> humour ; lens ;	A phonetic spelling 3 max
(ii)	holds lens in position / changes shape of lens / AW ; carries action potentials / (nerve) impulses, to brain ; focus point / has maximum visual acuity / has highest receptor cell density / correct ref. to colour vision ; protects (the cornea) ;	R contracts R images / information 4 max
(b) (i)	sterile gloves / sterile dressings used ; remove / cut, clothing to expose wound ; check for foreign object in wound ; apply pressure to wound ; detail of pressure eg pressure at edges of wound if object present ; raise leg above <u>heart</u> level ; AVP ; eg calm to lower heart rate	R remove object 3 max
(ii)	<i>pupil response test</i> dark room ; light shone into the eyes (one then the other) ; reflex action ; both pupils should, <u>constrict / react</u> , equally ; (unequal constriction) indicative of, drug use / damage to optic nerve / brain / AW ; correct ref. to RAPD ;	 3 max
	<i>blink reflex test</i> moving object towards eye / AW ; eyes should, blink / close <u>rapidly</u> ; (because) one of last reflexes lost as unconsciousness deepens / AW ; if reflex absent, patient in a coma / severe brain damage / AW ;	 3 max 5 max

- (c) Snellen chart / described ; **A diagram**
one eye covered at a time ;
viewed at 6m (20 feet) ;
read, from top down / largest to smallest / smallest they can see ;
explanation of 20/20 vision ;
those who cannot read may view pictures ;
(Snellen chart) tests distance vision ;
- near vision tested with reading card ;
asked to read (blocks of) text of different, font / letter, sizes ;
read at approx 30cm distance from eyes ;
- AVP ; eg use of mirrors to give 6m distance

4 max**[Total: 19]**

Question	Expected Answers	Marks
2 (a)	matrix of <u>mitochondria</u> ;	1
(b) (i)	<p><u>active site</u> has specific shape ; only substrate, fits ; <u>complementary</u> shapes ; correct ref. to lock and key ; enzyme–substrate complex / ESC ; breaking / formation, of <u>bonds</u> in substrate ; induced fit / described ; lowers activation energy ; AVP ; eg forms H bonds</p> <p><i>Accept correctly annotated diagram(s)</i></p>	<p><i>R</i> same</p> <p>3 max</p>
(ii)	decarboxylase ;	A dehydrogenase 1
(c)	<p>cycle can keep going / AW ; oxaloacetate / starting compound, regenerated / not used up ; continuous supply of, electrons / reduced coenzyme ; for, electron transfer chain / ETC / oxidative phosphorylation ; continuous supply of ATP made ;</p> <p>AVP ; eg prevents end-product inhibition</p>	<p><i>R</i> – more ATP</p> <p>3 max</p>
		[Total: 8]

Question	Expected Answers	Marks
3 (a)	hydrolysed (into glucose) ; of glycosidic bonds ; (reaction catalysed) by enzymes ; AVP ; eg detail of bonds 1,4 - / 1,6	2 max
(b) (i)	<i>for 'strenuous cycling + rest' line on graph if no units do not award first fig marking point in candidate's answer</i> rapid increase ; A 'dramatic' increase for 6 minutes / to peak of 11 mmol dm ⁻³ ; decrease, gradually / immediately / steadily / slow / slower ; for 34 minutes / to (approx) 3 mmol dm ⁻³ ; A 3.0 – 3.5 at end of resting period blood lactate still higher than initial value ; other use of figs ; eg comparative time ref.	3 max
(ii)	1 respiration / breathing rate higher than when resting ; 2 <u>higher</u> intake of oxygen ; 3 (more) respiration can be aerobic / ora ; 4 (lactate) respired by, muscles / liver ; A oxidised / broken down R used 5 heart rate / blood flow / delivery of lactate, maintained ; 6 muscles 'squeeze' veins / vasodilation ; 7 prevents blood pooling in muscles / removes lactate from muscles ; 8 AVP ; detail of lactate breakdown (lactate → pyruvate)	2 max

- (c) *steroids*
- 1 stimulate **anabolic** reactions ;
 - 2 increase **protein synthesis** (in cells) ;
 - 3 increased aggression ;
 - 4 so athletes able to train, longer / harder ;
 - 5 increases competitiveness ;
 - 6 increases muscle, size / strength ;
 - 7 decreases body fat ;
 - 8 decreases body's own production of hormones ;
 - 9 decreases **immune** system's (ability to respond to pathogens) / AW ;
 - 10 damage liver ;
 - 11 named example of substance ; eg **nandrolone,**
testosterone, epitestosterone
 - 12 synthesised from steroids by body ;
 - 13 test not necessarily a reliable indicator ; *max 5 on each section*
- (Rh)EPO**
- 14 made by, **genetically engineered / recombinant** bacteria ;
 - 15 stimulates **erythrocyte** production ; **A RBC / haemoglobin**
 - 16 increases oxygen carrying capacity of blood ;
 - 17 increases **aerobic** performance ;
 - 18 increases blood **viscosity / haematocrit** / AW ;
 - 19 may reduce supply of oxygen to parts of body ;
 - 20 increased risk of blood clot / pulmonary **embolism** / heart attack / stroke ;
max 5 on each section
- general*
- 21 unfair competitive advantage / brings sport into disrepute / illegal
 - 22 AVP ; eg male characteristics in females / infertility
 - 23 AVP ;

8 max

QWC – clear and well organised using specialist terms, any three from;

**anabolic, nandrolone, testosterone, epitestosterone, protein synthesis,
immune, recombinant / RhEPO, genetically engineered, viscosity, embolism,
aerobic, erythrocyte, haematocrit**

1

[Total: 16]

Question	Expected Answers	Marks
4 (a) (i)	meiosis (II) not complete / AW ;	1
(ii)	167 ;; <i>allow 156 - 178</i> one mark for: correct answers but wrong degree of accuracy <i>OR</i> measurement of scale bar ÷ 90	2 max
(b)	all correct ;; <i>only credit correctly spelt responses</i> <i>mark as pairs for each mark (ie if both 'mitosis' labels correct , award 1 mark)</i>	2
(c) (i)	condom not <u>put on</u> , early enough / correctly / AW ; R not used properly holes / tears (in condom) / AW ; oil-based lubricants ; allow sperm through ; re-using condoms, qualified ; condoms used are old / have been incorrectly stored ; AVP ; eg use of non-kitemarked condoms comparative use of figs. ;	2 max
(ii)	viable sperm may remain (within vas deferentia post-vasectomy) ; (these sperm) may still fertilise egg during subsequent intercourse / AW ; unlikely that any secondary oocyte present in oviduct post tubal ligation / AW; AVP ; eg correct ref to intercourse too soon after vasectomy	2 max
(iii)	zero ;	1
(d)	(antisperm antibodies) <u>attach</u> to sperm antigens (on surface of sperm) ; <u>causing</u> sperm to be destroyed / AW ; detail of antibody action eg sperm clump together / decreased motility ; AVP ; eg interfere with sperm's ability to fertilise secondary oocyte eg (antisperm) antibodies produced by B lymphocytes	3 max
		[Total: 13]

Question	Expected Answers	Marks
5 (a)	<p>P chloroplast ; A named part of chloroplast</p> <p>Q cell wall / middle lamellae ;</p> <p>R <u>nuclear</u> membrane ;</p>	3 max
(b) (i)	<p>electrons leave chlorophyll molecules ;</p> <p>pass to electron acceptor ;</p> <p>then passes down chain of electron carriers ;</p> <p>held in membranes ;</p> <p>energy released as electrons pass down chain ;</p> <p>use to phosphorylate ADP / AW ;</p> <p>AVP ; eg correctly named membranes thylakoids / lamellae</p>	3 max
(ii)	<p>diffusion ;</p> <p>movement from area of high(er) concentration to area of low(er) concentration ;</p> <p>down concentration gradient ; R across / along</p> <p>AVP ; correct ref to pathway to stomata</p> <p>energy not required / passive</p>	2 max
(iii)	<p>phospholipids for, structural unit / hydrophobic barrier / diffusion of small molecules ;</p> <p>cholesterol for, <u>mechanical</u> stability / regulate fluidity / AW ;</p> <p>glycolipids for, cell recognition / receptors ;</p> <p>AVP ; eg unsaturated fatty acids increase fluidity</p> <p style="text-align: right;"><i>1 max if lipid type not specified</i></p>	2 max
(c)	<p><i>general</i></p> <p>G1 natural disasters / named, leading to loss of life on large scale ;</p> <p>G2 man-made disasters / named, leading to loss of life on large scale ;</p> <p>G3 immigration / emigration qualified ;</p> <p><i>food availability</i></p> <p>F0 food availability ;</p> <p>F1 increase in technology ; eg GM crops / artificial fertilisers</p> <p>F2 drought / flooding / poor climate leading to unstable food supply ;</p> <p><i>healthcare</i></p> <p>M1 vaccinations for infectious diseases ; eg small pox</p> <p>M2 better, healthcare / education / drugs / ora ;</p> <p>M3 people living longer ;</p> <p>M4 advances in medical technology ; eg scans / x-rays / screening</p> <p>M5 purification of water / sewage treatment / sanitary conditions ;</p> <p style="text-align: right;"><i>3 max for healthcare</i></p> <p><i>birth rate</i></p> <p>B0 birth rate / death rate ;</p> <p>B1 people choosing to have more / less children ; eg use of contraceptives</p> <p>B2 lower fertility rates in some parts of world ;</p> <p>B3 correct ref. to birth rate vs. death rate ;</p> <p>A1 AVP ; further detail</p> <p>A2 AVP ;</p>	7 max
	<p>QWC – legible text with accurate spelling, punctuation and grammar;</p> <p><i>Candidates should make no more than three different spelling errors, sentences should be accurately punctuated according to spoken English and text should be legible.</i></p>	1

[Total: 18]

Question	Expected Answers	Marks
6 (a) (i)	A-delta ;	1
(ii)	myelinated / insulated (axons) ; Schwann cells / nodes of Ranvier ; correct ref. to saltatory conduction / AW ; compared to progress of impulse along unmyelinated axon ; correct ref. to diameter of neurons ; AVP ; eg up to 50 times faster	3 max
(b)	reflex, action / arc / AW ; automatic response / innate ; does not involve conscious thought / brain ; correct ref to pathway involving, sensory <u>and</u> motor neurone / 3 neurones ; via spinal cord ; impulse to effector / muscle ; aims to minimise damage / AW ; impulses for pain to brain, take longer / have longer pathway ;	4 max
(c) (i)	lack of blood to area of brain (beyond the clot) ; will not receive, oxygen / named nutrient (eg glucose) ; respiration cannot occur ; no ATP production ; AVP ;	R less R less 2 max
(ii)	decreases / lowers, water potential of blood (plasma) / water potential becomes more negative ; water moves into blood, <u>from tissues</u> / <u>cells</u> ; by osmosis ; increases blood volume ; increases blood pressure ; bursts walls of (fragile) capillaries / AW ; leading to bleed ; AVP ; eg roughens walls of arterioles, increased risk of atheroma formation,	A hypertension / high blood pressure R arteries 4 max
(iii)	being male ; high <u>blood</u> cholesterol ; diet high in <u>saturated</u> fat ; smoking ; traumatic brain injury / surgery ; aneurysm ; ageing ; genetics, qualified ; eg family history immobility ;	2 max

[Total: 16]

2867 Genetics, Homeostasis and Ageing

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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

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

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit R = reject () = words which are not essential to gain credit _____ = (underlining) key words which must be used to gain credit ecf = error carried forward AW = alternative wording A = accept ora = or reverse argument
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Question	Expected Answers	Marks
1 (a)	classification (of organisms) ; hierarchical ; indicates how closely related species are ; similar genetically ; R same naming of organisms / identifies new organism / AW ; <u>binomial</u> system / example ; AVP ;	3 max
(b)	UTQRVP 2 /3 correct order ; 4 / 5 correct order ; ; all correct ; ; ;	3 max
(c)	<i>H. sapiens neanderthalensis</i> is the same species ; different genetically ; ref to alternative suggestion / eg <i>neaderthalensis</i> is a different species; ref to impossible to verify / AW ; different characteristics / named characteristics ;	1 max
(d)	adapt to the environment ; each isolated group interbreeds ; does not breed with other (isolated) groups ; genetic variation / AW, within group ; mutations ; selected for / different selective pressures ; gene pool does not mix with that of other groups ; ref to evolution of long term differences in genome / AW ; allopatric speciation / described eg named physical barrier ; AVP ;	4 max
(e)	world wide travel / intermingling of populations / no geographical isolation ; interbreeding ; so no genetic isolation ; shared gene pool / AW ; AVP / lack of selection pressure eg vaccination ;	2 max
(f)	chromosome number differs in two species ; cannot form, pairs / bivalents (in meiosis) / AW ;	1 max

[Total: 14]

Question	Expected Answers	Marks								
2 (a) (i)	random / spontaneous change ; in the, genetic material / DNA / chromosomes ; AVP ; eg distinction between chromosomal and gene mutation detail	2 max								
(ii)	the skin cell might slough off / AW ; the mutation only affects that individual ; the primary oocyte develops into the gamete / AW ; the mutation is passed on ; it may affect every cell (in offspring) ; AVP ; eg easier to, detect / treat	3 max								
(b) (i)	the male gamete / sperm only passes on the nucleus ; the male gamete / sperm does not pass on <u>mitochondria</u> / AW ; only the female gamete / oocyte passes on, <u>organelles</u> / <u>cytoplasm</u> / ora ; R egg / ovum	1 max								
(ii)	<u>matrilineal</u> ; R passed on by the mother only (in stem) no, recombination / crossing over, of genetic material from father / AW ; therefore indicates, similarities / evolutionary origin / AW ; AVP ; eg smaller number of bases / genes	2 max								
(c)	there are many mitochondria (per cell) ; effect is diluted / AW ; AVP ; eg fewer gene loci nuclear genes / AW, might mask the effect	1 max								
(d) (i)	<table border="1"> <thead> <tr> <th>term</th> <th>meaning</th> </tr> </thead> <tbody> <tr> <td><i>acute</i></td> <td>random / spontaneous (mutation) ; sudden onset ; not degenerative ; R short term 1 max</td> </tr> <tr> <td><i>prevalence</i></td> <td>the number of people with the disease (at a given time) ; per 100 000 (of population) ; 1 max</td> </tr> <tr> <td><i>point mutation</i></td> <td>involves only one base (pair in a DNA molecule) ; substitution / deletion / insertion ; affects only one gene ; 1 max</td> </tr> </tbody> </table>	term	meaning	<i>acute</i>	random / spontaneous (mutation) ; sudden onset ; not degenerative ; R short term 1 max	<i>prevalence</i>	the number of people with the disease (at a given time) ; per 100 000 (of population) ; 1 max	<i>point mutation</i>	involves only one base (pair in a DNA molecule) ; substitution / deletion / insertion ; affects only one gene ; 1 max	3 max
term	meaning									
<i>acute</i>	random / spontaneous (mutation) ; sudden onset ; not degenerative ; R short term 1 max									
<i>prevalence</i>	the number of people with the disease (at a given time) ; per 100 000 (of population) ; 1 max									
<i>point mutation</i>	involves only one base (pair in a DNA molecule) ; substitution / deletion / insertion ; affects only one gene ; 1 max									

continued

Question 2 cont'd	Expected Answers	Marks
(ii)	<p>this condition could be passed to you by your mother ; detail on how inherited / pedigree analysis / AW ;</p> <p>detail on symptoms /effect on family ; <u>all</u> your children are at risk ; whether you have symptoms or not ;</p> <p>if the mutation is passed on it may not develop ; (because) the normal mitochondria may mask the effect ; it is not possible to calculate probability ;</p> <p>if <u>maternal relatives</u> have LHON then your children are more at risk ; ref to pre-natal diagnosis / amniocentesis / CVS ; AVP ; eg whether to have children / abortion counsellor will not make decisions for her / ora</p>	4 max
(e)	<p>relevant detail on nerve impulse conduction eg Na^+ / K^+ transport no ATP / energy; for active transport ; to maintain resting potential ; ref, link reaction / Krebs cycle / TCA cycle / oxidative phosphorylation, not working ; R glycolysis</p> <p>ref to named respiratory enzyme ; AVP ; eg effect on, protein synthesis / enzyme structure</p>	3 max
		[Total: 19]

Question	Expected Answers	Marks
3 (a) (i)	(dependency ratio) rises until 2040 ; A 2035 and stabilises / plateaus ; comparative figures in support ;	2 max
(ii)	an improvement in, medical care / health ; life expectancy is increasing ; a decrease in the birth rate (from 1990s) / AW ; AVP ; eg 'baby boomers' / AW	2 max
(b)	T1 correct ref to data (both columns) ; T2 (ageing population) already a problem in 2005 ; <i>advantages</i> A1 elderly can provide child care ; A2 economic support / housing support ; A3 elderly fill jobs younger people don't want / example ; A4 more flexible working practices ; A5 frequently do voluntary work / example ; A6 have valuable experience of life / AW ; A7 have valuable skills / AW ; A8 time to listen and help / mentoring ; A9 primary historical source ; A10 AVP ; eg boost economy in, leisure services / holidays / other named example	4 max
	<i>disadvantages</i> D1 R refs to increase in population D2 the dependency ratio / AW, will increase / described ; D3 cost to society of (increase in) pensions ; D4 elderly need to work for longer / ref to ageism ; D5 increase in chronic long term diseases (needing treatment) / AW ; D6 (increased) funding needed for, NHS / medical facilities / new drugs ; D7 extra provision of aids eg mobility aids / tap attachments etc ; D8 pressure on, family / carers / provision of sheltered accommodation ; D9 increased taxation to cover costs ; D10 community / leisure facilities for elderly ; D11 need, cure / research into diseases / disabilities, associated with ageing ; AVP ; eg (increased) provision for elderly to contribute to society / named example / policing of crime against vulnerable elderly	4 max 7 max
	QWC – legible text with accurate spelling, punctuation and grammar;	1

Candidates should have no more than three spelling errors; sentences should be accurately punctuated according to spoken English and text should be legible.

continued

Question 3 cont'd	Expected Answers	Marks
(c) (i)	<p><i>ref to immunodeficiency neutral.</i></p> <p>poor nutrition / AW ; protein needed to make B / T cells / antibodies ;</p> <p>poor gas exchange / AW ; energy needed to make B / T lymphocytes / antibodies ;</p> <p>long term activity of immune system may decrease / AW ;</p> <p>hypothermia / ref to temperature control ; too cold for enzyme action, qualified ;</p> <p>AVP ;</p>	2 max
(ii)	<p>avoid contact with infected people ; avoid crowded places ; take up vaccine eg flu / pneumonia ; keep warm ; AVP ; ref to protein / antioxidants in diet</p>	<p>R better diet unqualified</p> <p>1 max</p>
		[Total: 15]

Question	Expected Answers	Marks
4 (a) (i)	below the forebrain ; A midbrain	1
(ii)	temperature regulation ; menstrual cycle ; spermatogenesis / oogenesis ; thyroxine production / metabolic rate ; osmoregulation ; AVP ;	2 max
(iii)	the vein lies between two capillary beds / AW ;	1
(iv)	they secrete hormones / named hormone ; into blood ; into the portal vein / pituitary gland ; detail ; eg named example	2 max

(v)

hormone	function	where produced
	(stimulates thyroid), to produce <u>thyroxine</u> ;	
oxytocin ;		
	stimulates the growth / development, of follicles / activates Sertoli cells / spermatogenesis ;	
anti diuretic hormone / ADH ;		

4 max

(b) (i)	describes the dispersion / distribution around the mean / AW ; high SD indicates wider spread / ora / AW ; 68% population falls within 1SD of mean (in normal distribution / population) ; ref to outliers / AW ; AVP ; eg correct ref to statistical calculation / correct formula / ref to reliability of the data	2 max
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continued

Question 4 cont'd	Expected Answers	Marks
	<p>(ii) (<u>anterior</u> pituitary) produces growth hormone ; cells would multiply uncontrollably ; R rapid by mitosis ; ref to oncogenes ; so more cells to produce hormone / faster / higher, production of GH ; AVP ; detail</p>	3 max
	<p>(iii) social problem / described ; harmful effects of height on body / named ; pressure on, other organs / named organs / brain ; tumour may become malignant / reduces risk of becoming malignant / forms secondaries ; by metastasis ; AVP ; detail</p>	2 max
	<p>(iv) <i>treatment</i> chemotherapy / radiation therapy / immunotherapy / complementary and alternative therapy (CAT) ; <i>reason</i> brain surgery may result in brain damage / suitable reason described ; AVP ; ;</p>	2 max
		[Total: 19]

Question	Expected Answers	Marks
5 (a)	<p><i>look for annotations / labels on Fig. 5.1</i></p> <p><i>structure</i></p> <p>1 lie embedded in, fat / muscle ; 2 supplied with blood, by the renal artery ; 3 drained, by renal vein ;</p> <p>4 functional unit / AW, is the, nephron / kidney tubule ; 5 cortex contains glomeruli / Bowman's capsule ; 6 medulla contains tubules ; 7 (medulla) made up of pyramids ; 8 correct ref to pelvis ; 9 opens into ureter ; 10 the ureter connects the kidney to the bladder / AW ; 11 AVP ; eg ref to other named structure in nephron eg <u>outer</u> cortex contains <u>most</u> glomeruli</p> <p><i>function</i></p> <p>12 excretion ; 13 removes waste products of <u>metabolism</u> ; 14 nitrogenous waste / urea ; 15 in urine ; 16 urea is toxic / AW ;</p> <p>17 removes excess ions / named ions ; R sodium alone 18 selective reabsorption ; 19 some ions / some water / <u>all</u> glucose ; 20 <u>osmoregulation</u> ; 21 maintains the concentration of, body fluids / blood / qualified ; 22 regulates (blood) pH / [H⁺] ; 23 homeostasis ; 24 AVP ; eg ref to formation of Na⁺ gradient in medulla</p>	5 max
	<p>QWC - clear, well organised using specialist terms ;</p> <p><i>At least 4 of the terms shown in bold: renal artery, renal vein, cortex, medulla, ureter, nephron, glomeruli(us), pyramids, pelvis, (waste products of) metabolism, nitrogenous waste / urea, selective reabsorption, osmoregulation, homeostasis , Bowman's capsule</i></p>	1
(b) (i)	<p>carcinogens in cigarette smoke / named example ; R tar enter blood stream and circulate to kidney tissue / AW ; mutates proto-oncogenes into oncogenes ; AVP ; eg ref to uncontrolled mitosis ref to tumour suppressor genes</p>	2 max

continued

Question 5 cont'd	Expected Answers	Marks
(ii)	metastasis occurs ; (cancerous cells) spread to other parts of the body ; (cancerous cells) divide uncontrollably ; by mitosis ; cells travel in, blood / lymph (vessels) ; secondary tumours more difficult to treat ;	3 max
(iii)	blood in the urine ; abnormal colour of urine ; pain qualified ; AVP ; eg nausea, weight loss eg detection of odour by dogs	1 max
(iv)	biopsy ; microscopic analysis of cells / AW ; cells have large nuclear cytoplasmic ratio / AW ; undifferentiated ; AVP ; ultrasound scan / CAT scan / MRI scan / intravenous pyelogram / renal arteriography	2 max
[Total: 17]		

Question	Expected Answers	Marks	
6 (a)		<i>Mark (i) & (ii) as a whole</i>	
(i)	<p>to increase Mary's awareness of her condition / AW ; to monitor the effect of diet (changes) ; untreated / the long term effects of, diabetes could be very serious / AW ; one of the following long term effects ; CHD, cardiovascular disease / described blindness peripheral neuropathy (risk of) gangrene the results could help Mary to <u>control</u> her blood glucose with diet ;</p>		
(ii)	<p>(in morning) should get a fasting blood glucose concentration / described / eliminates increase because of food eaten ; establishes base line / AW ; if this is high there is a real problem ; AVP ;</p>	5 max	
(b)	<p>avoid burgers / chips / fizzy drinks ; avoid sugar / refined CHO ; eat fibre / whole grain foods ; slow release / complex, CHO ; A starch eat foods with low GI / glycaemic index / avoid foods with high GI ; avoid saturated fat ; AVP ; eg eat a balanced diet</p>	3 max	
(c) (i)	<p>$\frac{21.5 - 15}{15} \times 100 ;$ = 40 (%) ;</p>	<p>A 43.3 (%) <i>correct method wrong answer ;</i> <i>correct answer only ; ;</i></p>	2 max
(ii)	<p>as diabetes increases so does gross proteinuria / AW ; affects approximately 1/3 of diabetics / incidence of gross proteinuria is less ; at similar rate ; looks like a causal effect / AW ; comparative figs in support ; AVP ;</p>	3 max	
(d) (i)	<p><u>allows all soluble</u> substances to pass through ; named example ; selective membrane / barrier ; allows substances less than 68 000 relative molecular mass, through / ora ; A within range 65 000 – 69 000 detail on named substance prevented from passing through ; AVP ; eg accurate ref to osmotic pressure / accurate ref to ultrafiltration R refs to selective absorption</p>	3 max	

continued

Question 6 cont'd	Expected Answers	Marks
(ii)	lets, large molecules / proteins, through ; loses, named valuable materials / red blood cells, from the blood ; glomerular filtration stops /decreases / less efficient ; blood rushes through the kidney <u>too fast</u> to be filtered properly / AW ; AVP ; eg may affect reabsorption renal failure	2 max
		[Total: 18]

Question	Expected Answers	Marks
7 (a)	<i>inherited</i> genetic / caused by gene (mutation) ; passed on from parent(s) ; AVP ; eg ref to alleles	2 max
	<i>acquired</i> developed during lifetime ; stimulated by environmental factor / AW ; eg HIV / immunosuppressive drugs etc ;	2 max
(b) (i)	B lymphocytes develop into plasma cells ; by mitosis ; when an antigen is present / AW ;	2 max
(ii)	bacteria / virus / protoctist ;	1
(iii)	antibodies are passed from the mother / AW ; natural / passive, immunity ; (antibodies) cross the placenta ; (antibodies) present in breast milk ; AVP ; eg ref to how long antibodies last ref to development of child's immune system	2 max
(c) (i)	X^n ;	1
(ii)	<i>if diagram given A points where possible</i> (recessive allele) carried by, female / mother ; passed on by gamete with mutant X / AW ; always expressed in male ; as only one X ; never passed by male to sons ; always passed by male to daughters ; AVP ; eg detail	3 max
(iii)	bone marrow transplant ; vaccination to give, passive immunity / antibodies ; gene therapy ; AVP ; eg blood transfusion qualified	2 max
(d)	quality of life of child ; whether to have children ; whether to tell relatives ; ref to designer babies / use of IVF ; ref to gene therapy ; individuals may not wish to be screened ; treatment / cure may not be available ; AVP ; ; eg genetic diseases become rare, funding for research may be less	4 max
		[Total: 18]

Grade Thresholds

Advanced GCE (Subject) (Aggregation Code(s))
January 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2856	Raw	60	45	39	33	27	22	0
	UMS	90	72	63	54	45	36	0
2857	Raw	60	50	44	38	32	26	0
	UMS	90	72	63	54	45	36	0
2858/B	Raw	120	95	83	72	61	50	0
	UMS	120	96	84	72	60	48	0
2866	Raw	90	65	57	49	41	33	0
	UMS	90	72	63	54	45	36	0
2867	Raw	120	87	77	67	57	47	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
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	1.6	11.1	23.8	57.1	90.5	100.0	65
7886	0.0	0.0	28.6	42.9	100.0	100.0	7

72 candidates aggregated this series

For a description of how UMS marks are calculated see:

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

Statistics are correct at the time of publication.

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