

Human Biology

Advanced GCE A2 7886

Advanced Subsidiary GCE AS 3886

Mark Schemes for the Units

June 2007

3886/7886/MS/R/07

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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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**Mark Scheme 2856
June 2007**

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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	A	= alternative wording
	ora	= accept or reverse argument

Question	Expected Answers	Marks
1 (a) (i)	bacterium / <i>Mycobacterium tuberculosis</i> / bacillus ;	1
(ii)	(gradually) increases ; decrease, after 2001 / in 2002 ; figs to support ;	2 max
(iii)	<i>suggest</i> overcrowding / dense population ; poor quality housing / living conditions / AW ; more homelessness ; greater proportion of drug users ; greater proportion of HIV positive ; immigration / influx, of people from area with greater TB incidence / AW ; AVP ; e.g. better diagnosis, qualified ref. to air pollution	2 max
	<i>explain</i> airborne / droplet infection ;	3 max
(b)	antibiotics ; R vaccination named suitable e.g. (isoniazid) / named alternative drug ; six months/ long, course ; ref. to DOTS ; AVP ; e.g. detail of DOTS, combination of antibiotics, ensure course completed	3 max

[Total:9]

Question	Expected Answers	Marks
2	<p>(a) humans have small SA to volume ratio ; large energy demand / high metabolic rate ; named metabolic process requiring energy e.g. active transport / muscle contraction / biosynthesis ; (therefore) high (aerobic) respiration rate ; requiring, large O₂ supply / high rate of CO₂ removal ; AVP ; e.g. 2nd metabolic process requiring energy</p>	3 max
	<p>(b) thin cells / squamous epithelium / thin walls ; single layer of cells ; presence of surfactant ; presence of elastin / elastic tissue, / AW ; many capillaries around alveolus ; (alveoli) in close contact with blood capillaries ; short, <u>diffusion</u> distance from air to blood ;</p>	4 max
	<p>(c) the chemical / surfactant, not produced ; water present / produced ; with high surface tension ; due to hydrogen bonding ; AVP ;</p>	3 max

[Total: 10]

Question	Expected Answers	Marks
3 (a)	polysaccharide ; glucose ; glycosidic ; condensation ; water ; muscle ; energy ; respiration ;	8

Question	Expected Answers	Marks
4	<p>1 place on left hand side of chest ;</p> <p>2 between 4th and 6th rib ;</p> <p>3 listen to sounds ;</p> <p>4 move stethoscope slightly and listen again ;</p> <p>5 lub dub(/p) sounds ;</p> <p>6 valves closing ;</p> <p>7 lub = AV valve closure / dub(/p) = SL valve closure ;</p> <p>8 count number of beats in a, short period / named period, / calculate heart rate ;</p> <p>9 rate ;</p> <p>10 detection, rhythm defect / named e.g. (bradycardia / tachycardia / arrhythmia) ;</p> <p>11 arrhythmia) ;</p> <p>12 detection of, heart murmur / valve defect ; turbulence / regurgitation ;</p> <p>13 passes open AV valves causing them to vibrate ;</p> <p>14 AVP ; AVP ; e.g. used in taking blood pressure detail e.g. Korotkoff sounds caused by turbulence as blood squeezes past cuff 'whoosh' sound linked to blood entering ventricles detection of 'hole in the heart' / atrial septal defect</p>	9 max

QWC – clear well organized use of specialist terms

At least 3 of the terms shown in bold: diaphragm, **lub dub(/p)**, , **turbulence, regurgitation, AV valves, SL valves, bradycardia, tachycardia, arrhythmia, heart murmur, bicuspid, tricuspid, aortic** 1

[Total:10]

Question	Expected Answers	Marks
5		
(a)	(i) 0.8s ; ; <i>one mark for</i> correct answer no units OR $\frac{40 \times 0.4}{20}$;	2 max
	(ii) impulse spreading through, ventricles / Purkyne tissue ;	1
	(iii) R to S ;	1

(b)

patient	diagnosis	cause	treatment
E	bradycardia ;		artificial pacemaker / (if not threatening) no treatment ;
F	ventricular fibrillation ;	myocardial infarction / heart attack / AW ;	
G		impulses not passing through / damaged, AVN / Bundle of His / Purkyne tissue, AW ;	artificial pacemaker / no treatment ;

[Total:10] 6 max

Question	Expected Answers	Marks
6 (a)	phospholipid bilayer ; detail e.g. heads point out / tail point in ; proteins present in it ; detail e.g. description of intrinsic / extrinsic ; fluid mosaic ; ref. to cholesterol ; correct ref. to, glycoproteins / glycolipids ;	3 max
(b)	A osmosis ; B diffusion ; C active transport ; D facilitated diffusion ;	4
(c)	less ATP / energy available ; less K ⁺ pumped in ; K ⁺ (still) diffuse out ;	2 max
(d) (i)	antibodies present ; complementary / bind, to the antigen ;	2 max
(ii)	<i>any two from</i> if recently given a donation ; it received a donation ; if anaemic ; underage ; qualified ref. to weight ; correct ref. to genetic disorder e.g., sickle cell / Crohn's ; current infection / named infection ; recent piercings ; recent tattoo ; qualified ref. to overseas travel ; sex with a high risk group e.g. drug users ; highly promiscuous ; pregnant ; drug user ; certain medications ; recent surgery ; recent immunisations ; AVP ;	2 max

[Total: 13]

**Mark Scheme 2857
June 2007**

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Question	Expected Answers	Marks
2 (a) (i)	<p><i>description</i></p> <p>no deaths under 40 ; number of deaths increase from 40-44 age group up to 75-79 age group / AW ; max number of deaths in 75 to 79 age group / number of deaths falls after 75 to 79 / AW ; in each age group more men die than women ; comparative figures ;</p> <p><i>reasons</i></p> <p>cancer takes, a long time / 20 to 30 years, to develop ; men who smoked smoke more cigarettes than women who smoked / AW ; more men smoked than women ; fewer people over 80 (so) smaller number of deaths from lung cancer / AW ; AVP ;</p>	<p>3 max</p> <p>3 max</p> <p>4 max</p>
(b)	any two from MRI, PET, X-ray, CT, biopsy ; ;	2
(c)	<p>1 stop people starting / encourage people to give up smoking ;</p> <p>2 target specific groups / named group / visit places of work / schools / colleges / clubs ;</p> <p>3 educate / inform of harmful effects of smoking ;</p> <p>4 educate / inform about the benefits of giving up / not starting ;</p> <p>5 use leaflets / posters / adverts / websites / role models ;</p> <p>6 provide classes / discussion groups ;</p> <p>7 provide support / counselling ;</p> <p>8 use of epidemiology ;</p> <p>9 example of a campaign ;</p> <p>10 AVP ;</p> <p>11 AVP ; e.g. correct reference to asbestos</p>	6 max
	<p>QWC – legible text with accurate spelling, punctuation and grammar; <i>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.</i></p>	1

[Total: 13]

Question	Expected Answers	Marks
3 (a)	<p><i>method</i> crown-rump length ; biparietal diameter of head ;</p> <p><i>detail</i> ultrasound ; electronic calipers ; reference to comparison with standard measurements ; AVP ; e.g. details of how ultrasound is used</p>	4 max
(b) (i)	<p>$\frac{7}{72} \times 100$; = 10% ; correct answer only ;;</p>	2 max
(ii)	<p>nicotine ; constricts placenta / foetal arterioles / arteries ; reduces oxygen / glucose to foetal tissue ; less energy / raw materials / named raw material available for growth / less respiration ;</p> <p><i>or</i></p> <p>carbon monoxide ; combines with haemoglobin ; irreversibly ; reduction in amount of oxygen transported by (maternal) blood to foetal tissue ; less energy available for growth ;</p>	3 max
(c) (i)	reduce risk of neural tube defects / spina bifida / other named neural tube defect ; R nervous system	1
(ii)	<p>lacking in diet ; not absorbed ; AVP ; e.g. not taking supplements not stored / water soluble</p>	1 max

[Total: 11]

Question	Expected Answers	Marks
4 (a) (i)	A capsid / protein coat ; B enzyme / reverse transcriptase ; C RNA / nucleic acid ;	3
(ii)	HIV destroys, T helper / T ₄ cells / T lymphocytes ; HIV replicates and increases in numbers / number of T helper cells decrease ; immune response weakened / body can't fight disease ; opportunistic infections / named ; body can't destroy cancer cells / named cancer ; AVP ; e.g. detail of action of T helper cells	3 max
(b) (i)	homosexual / heterosexual, multiple partners / implied ; use condoms ; intravenous drug users / implied ; use sterile needles from needle exchange / don't share needles ; babies born to women with, AIDS / HIV ; special arrangements during delivery / don't breast feed ; AVP ; AVP ; <i>max 2 for naming groups</i>	4 max
(ii)	HIV has a high <u>mutation</u> rate ; contains RNA not DNA as genetic material ; vaccine made will not be effective against different forms of virus ; <u>antigen</u> / <u>protein coat</u> changes ; hides in, T helper / T ₄ cells ; AVP ; attenuated / live vaccine not safe to trial	2 max
(c) (i)	an increase / spread / outbreak of cases, <u>across the world</u> / AW ;	1
(ii)	not had chance to develop immunity to it / most people infected with it will develop disease ; vaccines not available in advance / AW ; difficult to diagnose / don't understand how it is transmitted ; lots of international travelling ; AVP ;	2 max
		[Total: 15]

Question	Expected Answers	Marks
5 (a) (i)	specialised / group of cells ; working together ; to carry out a particular function / named example ;	2 max
(b) (i) P	lymphocyte ;	2
Q	neutrophil / phagocyte ;	
(ii)	bone marrow ; thymus gland ;	2
(iii)	1 destroy bacteria / pathogen / AW ; 2 chemotaxis / attraction described ; 3 attachment of bacteria to membrane of cell / described ; 4 bacteria ingested / engulfed / moved into cell ; 5 by endocytosis / phagocytosis ; 6 phagosome formed / described ; 7 fuses with lysosome ; 8 enzymes from lysosome ; 9 hydrolytic / enzyme action described ; 10 AVP ; A labelled diagrams ignore incorrect name of leucocyte	5 max

[Total: 11]

**Mark Scheme 2858/01
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1 (a) (i)	maintains constant pH / AW ; AVP ;	1 max
(ii)	same <u>water potential</u> (as cytoplasm) ; A same solute potential	1
(iii)	change, shape / tertiary structure ; ignore active site refs AVP ; e.g. correct ref to bonds	1 max
(b)	cells would, burst / swell, if solution is hypotonic / AW ; cells would shrink, if solution hypertonic / AW ; water would move in ; ora down a <u>water potential</u> gradient / AW ; by osmosis ;	2 max
(c)	<p><i>property</i> (water is) solvent / described ; <i>reason</i> ref solvent for, <u>polar</u> molecules / named example ; metabolic reactions / named reaction, occur in solution / AW ; ref hydrogen bonding ;</p> <p><i>property</i> high specific heat capacity / described ; <i>reason</i> maintainance of (stable) temperature ;</p> <p>AVP ; ; e.g. low viscosity / flows easily (<i>property</i>) liquid at body temperature(<i>property</i>) allows cytoplasmic streaming (<i>reason</i>)</p>	<p><i>max 1 for property</i> 2 max</p>

Question	Expected Answers	Marks
(d)	<p>1 ref to livelihood / making a living ;</p> <p>2 detail / slash and burn agriculture ;</p> <p>3 (land needed for) grazing / crops / dwellings ;</p> <p>4 ref loss of habitats ; ora</p> <p>5 ref plants as sources of drugs / example ;</p> <p>6 ref sustainable use ; ora</p> <p>7 ref to consequence of deforestation ; e.g. erosion, global warming</p> <p>8 AVP ; e.g. evidence of further research, local involvement, eco-tourism, example of sustainable technique</p> <p style="text-align: right;"><i>max 3 for any one argument</i></p>	4 max
(e) (i)	<p>90 ; ;</p> <p><i>wrong answer but correct method (length / magnification) = max 1</i></p>	2 max
(ii)	<p><i>ecf for incorrect tissue</i></p> <p><i>max 1 for named tissue(s)</i></p> <p><i>tissue</i> (smooth) muscle ;</p> <p><i>function</i> contracts to constrict lumen ; ora regulates blood,pressure / flow ;</p> <p><i>tissue</i> elastic (tissue) ;</p> <p><i>function</i> stretch (and recoils) qualified ; e.g. ref to high pressure or systole smooths out blood flow ; (recoil) propels blood forward (in diastole) ;</p> <p><i>tissue</i> endothelial / endothelium ; A (squamous) epithelium</p> <p><i>function</i> reduces friction ; A smooths flow</p>	2 max
(f)	<p><i>max 1 if order incorrect</i></p> <p>fixing / AW ;</p> <p>detail e.g. with methanol ;</p> <p>add named stain ;</p> <p>further detail e.g. time ;</p> <p>washing ;</p> <p>detail of washing e.g. until smear looks pale pink, ratio of water to stain ;</p> <p>(blotted) dry ;</p> <p>AVP ; e.g. ref to differential staining</p>	3 max

Question	Expected Answers	Marks
(g) (i)	ref to ribosomes ; protein synthesis ; package in vesicles, (for) transport to Golgi body / AW ; AVP ; e.g. detail of protein synthesis	2 max
(ii)	synthesis of / makes, viral proteins / AW ; (viruses have) protein coats ; (viral) enzymes ; AVP ; e.g. evidence of research detail protein synthesis	2 max
		[Total: 22]

Question	Expected Answers	Marks
2 (a) (i)	phagocytosis ; engulf, bacteria / foreign particles ; destroys/digests, bacteria ; AVP ;	2 max
(ii)	(woman has) an infection / named infection ; R ref lactobacilli (reproductive tract) is route for some pathogens ; ref <u>non-specific</u> immune system ; AVP ; e.g. neutrophils can leave capillaries, inflammation, IUD	1 max
(b) (i)	differentiate into same type of cell / AW ; A carry out same function (daughter cells are) <u>genetically</u> identical ; A clone same number of chromosomes ; ref meiosis (produces, haploid / genetically different, cells) ;	2 max
(ii)	<i>prophase</i> 1 chromosomes condense ; 2 (and) become visible ; 3 detail ; e.g .description of chromosome appearance <i>metaphase</i> 4 chromosomes line up ; 5 along equator ; 6 detail ; e.g. spindles attach to centromere <i>anaphase</i> 7 centromere splits ; 8 chromatids separate to opposite poles ; 9 detail ; e.g. centromere first <i>telophase</i> 10 chromatids / chromosomes, decondense ; 11 (chromosomes) no longer visible ; 12 chromatids now called chromosomes ;	6 max
(c)	glycogen converted to glucose / AW ; ref hydrolysis ; for respiration / energy <u>source</u> / AW ; glycogen cannot move out ; (because) glycogen is insoluble ;	2 max
(d) (i)	<i>treat ref to HIV as neutral</i> (unprotected) sex ; in, semen / vaginal fluid ; (if) one partner is infected ; AVP ;	1 max

Question	Expected Answers	Marks
	<p>(ii) virus carries oncogenes ; (virus causes) proto oncogenes mutate ; ref uncontrolled cell division ; ref to tumour formation ; ref to metastasis / spread ; AVP ; e.g. reference to background research ref to repressor genes ;</p>	3 max
	<p>(iii) (seen to be) encouraging / promoting, sex / AW ; ref to target population / young / single ;</p> <p>ref to testing issues ; ref to risk associated with new vaccine / AW ;</p> <p>AVP ; issue plus consequence AVP ;</p>	2 max
(e)	<p>(i) (other tissues have) blood vessels ; cancer spreads (in blood vessels) ; ora ref to secondary tumours / AW ; AVP ; e.g. ref to malignancy cells may revert back</p>	2 max
	<p>(ii) chemotherapy ; radiotherapy ; AVP ; AVP ;</p>	2 max
		[Total: 23]

**Mark Scheme 2866
June 2007**

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Question	Expected Answers	Marks
1 (a) (i)	A nucleus ; B striations / A and I bands ;	2
(ii)	28 – 29 ; $10 / 350 = 0.02857$; $\times 1000 = 28.57$; A rounded up answers at either stage	2
(b) (i)	magnification not high enough / too small to be seen (with light microscope) ; resolution not good enough / AW ;	1 max
(ii)	mitochondria provide ATP / energy ; from <u>aerobic</u> respiration ; muscle very active / AW ; AVP ; e.g. exercise increases number of mitochondria	2 max
(c)	collection of similar / specialised cells ; working together ; to perform a particular function / job ; AVP ; e.g. detail of structure	2 max
(d)	provides ready energy store / AW ; insoluble ; does not affect water potential (of cell) ; compact shape / does not take up much room ; easily broken down / hydrolysed (to glucose) ; large number of terminals / AW ; for <u>enzyme</u> action ; AVP ;	3 max
(e)	20-60 mins exercise per day / 3-5 times per week ; e.g. of type of aerobic exercise ; working at approx, 70% of VO_2 max / 60-85% max heart rate ; may be in 10 min bouts or continuous ; AVP ; e.g. health problem(s) taken into account first	2 max

Question	Expected Answers	Marks
(f)	<i>oxygen deficit</i>	
	1 difference between oxygen demand and supply / AW ;	
	2 due to an inadequate blood supply to muscles / AW ;	
	<i>EPOC</i>	
	3 total oxygen consumed after exercise in excess of pre-exercise level ;	
	4 lactate / lactic acid, produced by anaerobic respiration ;	
	5 transported to liver ;	
	6 converted to pyruvate ;	
	7 oxygen needed after exercise to oxidise pyruvate ;	
	8 ref to link reaction ;	
	9 ref to Krebs cycle ;	<i>max 3 for EPOC</i>
	10 use of figs ;	
	11 AVP ;	
	12 AVP ; e.g. reoxygenating myoglobin / haemoglobin, regenerate, CP / creatine phosphate	5 max

[Total: 19]

Question	Expected Answers	Marks
2 (a)	(i) (sudden) blow to head / head suddenly & violently hits an object ; causes (physical) damage to the brain ; named e.g. ;	1
	(ii) cerebellum accurately labelled ;	1
	(iii) poor / loss of balance / posture ; poor / loss of (muscle) coordination / named example ; poor / loss of fine manipulation / AW ; problems with eye movement ; AVP ;	2 max
(b)	(i) (patient) lies inside magnet / scan uses magnets ; computer measures differences between strength of magnetic field / magnetic fields, in different parts of brain measured ; haemoglobin contains iron ; this has (small) effect on magnetic field ; effect less / smaller when oxyhaemoglobin present ; information about distribution of oxyhaemoglobin in brain ; represents rate of respiration ; thus activity of different areas ; damaged areas less respiration ; AVP ;	4 max
	(ii) MRI better at showing soft tissues / ora ; does not involve X rays / ora ; X rays potentially harmful / AW ; CT scans better at detecting cancer / tumours ; MRI scans provide more information / AW ; AVP ;	2 max

Question	Expected Answers	Marks
(c)	<ul style="list-style-type: none"> 1 scar tissue ; 2 formed by glial cells ; 3 containing proteoglycans ; 4 axons cannot grow through it ; 5 (many) inhibitors present ; 6 prevent regrowth / AW ; 7 neurones need trophic factors to grow ; 8 eg nerve growth factor / NGF ; 9 particular combination needed ; 10 specialised cells cannot / do not, divide ; 11 AVP ; 	4 max
	<ul style="list-style-type: none"> 12 enzyme chondroitinase ; 13 made by bacteria ; 14 break down scar tissue ; 15 so axons can grow through / regenerate / AW ; 	
	<ul style="list-style-type: none"> 16 stem cells ; 17 can differentiate / specialise ; 18 forming new neurones / glial cells / replace damaged tissue ; 19 eg foetal stem cells in stroke victims / Parkinson's disease ; 	
	20 AVP ;	7 max
	<p>QWC – legible text with accurate spelling, punctuation and grammar ; <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
3 (a)	more than one egg / ovum / oocyte released at once ; fertilised by different sperm ; gives non-identical / dizygotic babies ;	2 max
	one, egg / ovum / oocyte fertilised / zygote ; splits / AW ; each cell grows into separate embryo ; identical / monozygotic babies ;	2 max 3 max
(b) (i)	the blood group alleles / I ^A , I ^B , I ^O ; (code for) antigens / cell markers (on rbc's) ; two types A and B ; inherited / genetically determined / passed on from parents ; no antigens gives group O / both antigens gives AB, just antigen A gives group A / just antigen B gives group B ;	3 max
(ii)	mixing of baby's and mother's blood at, birth / named sensitising event ; mother makes, antibodies against Rh ⁺ / IgM ; no danger to first baby ; <u>second rhesus positive</u> baby ; smaller antibodies / IgG, (cross placenta) ; blood agglutination / clumping ; haemolytic disease of newborn / HND ; may be fatal ; AVP ;	3 max
(iii)	immunisation ; injections of, RhoGAM / IgG / IgM / anti-Rhesus antibodies ; A anti-D 28 weeks / at sensitising event ; if missed given at birth ; blood tested for IgG / antibodies against Rh antigens ; AVP ;	2 max

Question	Expected Answers	Marks
(c)	<p>1 first, sign / hormone is (Human) chorionic gonadotrophin / hCG ;</p> <p>2 hCG produced by blastocyst / described ;</p> <p>3 stimulates corpus luteum ;</p> <p>4 to continue secreting (oestrogen) and progesterone ;</p> <p>5 oestrogen proliferates endometrium / AW;</p> <p>6 progesterone maintains endometrium / AW ;</p> <p>7 hCG peaks at about 55 days ; A answers between 50-60 days</p> <p>8 progesterone concentration decreases around day 28 ;</p> <p>9 as placenta takes over ;</p> <p>10 then rises rapidly ;</p> <p>11 until day 275-280 ;</p> <p>12 full term ;</p> <p>13 placenta delivered / AW ;</p> <p>14 all placental hormones / named, decrease ;</p> <p>15 hCG decreases until about day 55 / 8th week ;</p> <p>16 AVP ;</p> <p>17 AVP ;</p> <p>QWC – clear well organised using specialist terms ; <i>At least 4 of the terms shown in bold:</i> <i>(human) chorionic gonadotrophin</i> <i>blastocyst</i> <i>corpus luteum</i> <i>oestrogen</i> <i>progesterone</i> <i>endometrium</i> <i>full term</i> <i>placenta</i> <i>menstruation</i> <i>myometrium</i> <i>oxytocin</i> <i>prolactin</i></p>	<p>7 max</p> <p>1</p>

[Total: 19]

Question	Expected Answers	Marks
4 (a)	deoxyribose sugar in DNA, ribose in ATP ; 1 phosphate group in DNA, 3 in ATP ; no pyrophosphate bonds in DNA, 2 in ATP ; AVP ; e.g. 4 different types of nucleotide / named in DNA	2 max
(b) (i)	denature proteins / enzymes ; bonds broken / change in shape of active site ; substrate no longer fits / AW ; enzymes not able to work at optimum level ; AVP ; e.g. named bonds	2 max
(ii)	phosphate group removed from ATP ; transferred to / phosphorylates, other molecule ; named eg ; so energy not lost as heat / energy transferred to other molecule ; used as chemical energy ; ref to transfer to named action ; only a small quantity released as heat / AW ; excess / ref to inefficient coupling ; AVP ; e.g. detail	2 max
(c) (i)	chromosomes condense / coil up / AW ; homologous chromosomes, pair up / form bivalents ; crossing over / described ; chiasmata formation ; nuclear membrane begins to break down ; spindle begins to form / centrioles move to poles ; <i>accept clearly labelled diagrams</i>	4 max
(ii)	DNA replication / detail ; protein synthesis / detail ; spindle formation ; depolymerisation of spindle fibres ; A spindle contraction replication of organelles / named ; AVP ; eg formation of new nuclear membrane	2 max

[Total: 12]

Question	Expected Answers	Marks
5 (a) (i)	0.4 tonnes (of grain) yield per hectare ; ; <i>max 1 mark if units omitted</i>	2
(ii)	decreases biodiversity / AW ; increased soil erosion ; increased greenhouse effect ; as less carbon dioxide used by trees / AW ; may contribute to global warming ; loss of habitat for animals / plants ; may lose medicinally important species ; loss of gene pool / seed bank (for agriculture) ; unpredictable effects on food webs ; AVP ;	4 max
(b) (i)	gain average data ; increases reliability ; effects may only be seen over several years / AW ; weather / other named variable, may vary yearly ; may have affect on results ; AVP ;	2 max
(ii)	application of inorganic fertiliser, produces the highest yield ; inorganic fertiliser increases yield above that of manure ; application of no fertiliser produces lowest yield ;	2 max
(iii)	can be used over long period of time ; and still be successful in producing resource being harvested ; correct ref to harm done by inorganic fertiliser e.g. to soil structure ;	2 max
		[Total: 12]

Question	Expected Answers	Marks
6 (a) (i)	engulf / description, foreign particles / cells / debris ; at site of entry / AW ; and digest / break down ; using hydrolytic enzymes ; lysosomes fuse with vacuole ; non-specific response ; AVP ; e.g. macrophages act as APCs	3 max
(ii)	antibiotics / named example ; A <i>anti-inflammatories</i> / <i>antiseptics</i>	1
(b) (i)	cornea bends light rays the most / first ; A annotations on Fig. 6.1 lens responsible for fine tuning (of refraction) / AW ;	2
(ii)	refraction / refracted ;	1
(c) (i)	rods <u>and</u> cones ;	1
(ii)	spinach proteins act as transducers ; light changes shape of spinach protein / AW ; causes change in electrochemical gradient across cell membrane ; (this) generates action potential in bipolar cell / lifts inhibition of bipolar cell ; transmitted across synapse in ganglion cell ; AVP ;	2 max
		[Total: 10]

**Mark Scheme 2867
June 2007**

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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

x = incorrect response (errors may also be underlined)
^ = omission mark
bod = benefit of the doubt (where professional judgement has been used)
ecf = error carried forward (in consequential marking)
con = contradiction (in cases where candidates contradict themselves in the same response)
sf = error in the number of significant figures
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. 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
	NOT	= separates marking points
	R	= answers which are not worthy of credit
	()	= reject
	_____	= words which are not essential to gain credit
	ecf	= (underlining) key words which must be used to gain credit
	AW	= error carried forward
	A	= alternative wording
	ora	= accept or reverse argument

Question	Expected Answers	Marks
1 (a) (i)	37 (± 0.5) $^{\circ}\text{C}$; A 98.4 (± 1.0) $^{\circ}\text{F}$	1
(ii)	hypothalamus ; autonomic / parasympathetic / sympathetic (nervous system) ; A skin / temperature / thermo, receptors / nerve endings in skin	2
(iii)	<i>if the body is too cold</i> C1 increases (B)MR / described ; C2 due to thyroxine ; C3 <u>thermogenesis</u> ; C4 shiver ; C5 contraction of muscles releases thermal / heat (energy) ; R energy alone C6 from respiration ; C7 (smooth) muscle, in arteriole walls (to skin), contracts ; R constrict C8 <u>vasoconstriction</u> ; C9 diverts blood from skin surface ; C10 erector muscles contract; C11 raise hairs on skin ; C12 trap insulating layer of (warm) air; 4 max	
	<i>if the body is too hot</i> H1 <u>evaporation</u> of sweat/water ; H2 high latent heat of evaporation ; H3 removes heat (from blood) ; H4 vasodilation/described ; H5 heat lost from blood by conduction / convection / radiation H6 AVP ; e.g. homeostasis/negative feedback/further detail about hormones/describe thermogenesis ; 4 max	6 max
(b) (i)	$\frac{68}{1.6^2}$ = 26.56 ; ; correct method wrong figures 1 max not to two decimal places 1 max	2

continued on next page

Question 1 **Expected Answers**
cont'd

- (ii) *Nilotic male* :
large surface area to volume ratio ;
loses / heat faster ; **A** easier

Inuit male
small surface area to volume ratio;
loses heat more slowly ;
conserves heat ;

ref to limb length ;
ref to body shape ;
ref to natural selection/qualified ;
ref to other adaptation ;

5 max

[Total: 16]

Question	Expected Answers	Marks
2 (a)	<p>the antibodies attack / bind to/ recognise as foreign, own cells / self antigens ; <u>autoimmunity</u> ; destroy (β cells) ; detail e.g. complementary shape; R same shape no insulin produced / need insulin injections ; diabetes <u>mellitus</u> ; <u>type 1</u> diabetes / <u>insulin dependent</u> diabetes / IDDM ; high blood sugar / hyperglycaemia ;</p>	4 max
(b) (i)	<p>homeostasis qualified ; ref to why insulin takes time to work ; varies / oscillates / AW, around a set point ; dynamic equilibrium ;</p>	2 max
(b) (ii)	<p>has diabetes (mellitus) ; glucose not converted to glycogen ; or absorbed into, cells / liver / muscle ; therefore blood sugar rises / stays high ; until glucose respired / excreted in urine ; AVP ; e.g. description of Type 2 diabetes</p>	3 max
(c) (i)	<p>refined sugar is soluble / easily digested ; easily / quickly, absorbed ; (therefore) surge of glucose in blood / AW ; starch is a complex, CHO / polysaccharide ; A ora slow release into blood ; available as required / AW ; AVP ; e.g. excreted / wasted</p>	3 max
(c) (ii)	<p>excess glucose is stored as fat AW ; <u>lipogenesis</u> ; saturated fat carried with cholesterol / raises (blood) cholesterol levels ; by LDLs / increases LDL:HDL ratio / ora ; deposited in <u>walls</u> of arteries ; obstructs lumen of <u>coronary</u> artery ; causes, CHD / heart attacks / MI / angina ; formation of plaques / atheroma / atherosclerosis ;</p>	3 max
(d)	<p>1 LDL lowered <u>most</u> by diet and statin combined ; A cholesterol for LDL 2 LDL also lowered by, diet / statin alone ; 3 effect on LDL cumulative / additive / AW ; 4 insulin concentration / insulin resistance, increased by statin only ; 5 insulin concentration / insulin resistance, decreased by diet only ; 6 insulin concentration / insulin resistance, diet and statin combined balanced each other out / no change ; 7 comparative figs in support ; 8 AVP ; A ref to groups</p>	4 max

[Total: 19]

Question	Expected Answers	Marks
3 (a)	<p>1 synaptic transmission slower / reduction in, neurotransmitters/acetyl 2 choline ; 3 loss of neurones ; 4 poor memory (for numbers) / AW ; 5 poor coordination ; AVP ; e.g. Alzheimer's disease qualified, Parkinson's Disease qualified, ref to Hippocampus qualified, cerebellum qualified</p> <p>6 cannot hear high pitched sound ; 7 hair cells die ; 8 in cochlea ; 9 ref to auditory nerve / cranial VIII ; 10 AVP ; e.g. arthritis may damage ossicles / described, ear wax, long exposure to loud noises, infection, head injury, stroke</p> <p>11 cells in retina lost ; 12 receptor / rods / cones ; 13 insoluble fragments, accumulate in lysosomes ; 14 continual break down of visual pigments ; 15 rhodopsin / iodopsin(s) ; 16 (age related) macular degeneration ; 17 macular area of sharpest vision / AW ; 18 causes, blind spots / blurring / distorted vision ; 19 protein in lens denatures / loss of elasticity / hardening / cloudy lens / AW ; 20 accelerated by diabetes (mellitus) ; 21 cataract ; 22 AVP ; e.g. detail on AMD</p>	7 max
	<p>QWC - clear, well organised using specialist terms ; <i>At least 4 of the terms shown in bold: hair cells, cochlea, neurone(s), auditory nerve, ossicles, retina, lysosomes, rhodopsin, iodopsin(s), macular degeneration, diabetes, cataract, receptor / rods / cones.</i></p>	1

continued on next page

Question 3 Expected Answers
con'td

- (b) (i) CT scan / computer assisted tomography ;
X-Rays ;
absorbed by different amounts in different structures / AW ;
computer builds up a 3D picture ;
may inject X-Ray opaque dye ;
AVP ; e.g. Alzheimer's disease can only be diagnosed after death

OR

- MRI scan / magnetic resonance imaging ;
patient lies in large magnetic chamber ;
computer picks up magnetic radiation ;
Hb contains iron therefore magnetic ;
indicates oxygenation of different tissues ;
AVP ; e.g. Alzheimer's disease can only be diagnosed after death

OR

- PET scan / positron emission tomography ;
inject 2-deoxyglucose ;
labelled / emits positrons ;
scanner picks them up ;
most active tissues take up most deoxyglucose ;
AVP ; e.g. Alzheimer's disease can only be diagnosed after death

OR

- cognitive tests ;
small test ;
detail ;
clock drawing test ;
detail ;
AVP ; e.g. Alzheimer's disease can only be diagnosed after death

3 max

- (ii) the disease is degenerative / AW ;
respect his independence / described ;
whilst giving adequate care / AW ;
may be aggressive / suspicious / paranoid / personality changes /
mood swings ;
burden of care may fall on her ;
may not be recognised by father in later stages ;
AVP ; e.g. demands on time / jobs given up,
may need to consider care home
AVP ; e.g. financial burden / worry about genetic inheritance

3 max

- (iii) obtain an accurate assessment of her father's condition / AW ;
consult, GP / Social Services ;
voluntary agencies / named ;
organise remedial help for her father e.g. simple cognitive exercises /
hearing aids / large print items ;
organise care at home if necessary / named e.g. meals on wheels /
help with dressing ;
AVP ; e.g. walking aids / respite care / consult council / financial help

2 max

[Total: 16]

Question	Expected Answers	Marks
4 (a)	<i>practical</i>	
P1	must be, correct tissue type / suitable match ;	
P2	correct blood groups ;	
P3	cannot use living donor / shortage of donors ;	
P4	must be correct size ;	
P5	must be, in healthy condition / used within 4 to 8 hours ;	
P6	recipient must be able to tolerate surgery ;	
P7	vessels must not leak ;	
P8	ref to infection, e.g. during surgery / from donor / use of immunosuppressives ;	
P9	AVP ; e.g. risks of anaesthesia / rejection / only extends life by 10 years / need to open thorax / invasive	4 max
	<i>ethical</i>	
E1	ref to pressure on relatives to donate ;	
E2	pressure on medical resources ;	
E3	cost compared to a larger number of life-saving cheaper operations ;	
E4	not right to interfere with nature ;	
E5	religious objection ;	
E6	condition may be self inflicted / described ;	
E7	AVP ; e.g. heart transplants for patients with genetic disease / increasing genetic load if survive to reproduce / cost qualified / choice of recipient / xenotransplants / ref to selling organs	4 max
		7 max
	QWC – legible text with accurate spelling, punctuation and grammar ; <i>Candidates should have no more than three different spelling errors, sentences should be accurately punctuated according to spoken English and text should be legible.</i>	1
(b)	1 take anti-rejection drugs <u>regularly</u> ; 2 eat a, healthy / balanced, diet ; 3 avoid / reduce, saturated fat / cholesterol / trans fats ; 4 reduce salt / low sodium diet ; 5 maintain normal weight ; 6 take exercise, qualified ; R vigorous 7 do not smoke ; 8 avoid contact with infections ; 9 avoid stress ; 10 increase unsaturated fat ; 11 increase, antioxidants / fruit & vegetables / vitamin E ; 12 decrease alcohol intake ;	4 max

continued on next page

Question Expected Answers
4 con'td

- (c) (i) (anti) A / a / α ;
 (anti) B / b / β ;
 AVP ; e.g. accurate ref to (anti) R / Rhesus / D ; *if list given mark first two* **2 max**

- (ii)
- 1 antigens on the cell (surface membrane) ;
 - 2 not on red blood cell's / AW ;
 - 3 HLA / human leucocyte antigen system ;
 - 4 coded for by six gene loci ; **A** four loci
 - 5 on chromosome 6 ;
 - 6 MHC / major histocompatibility complex ;
 - 7 many alleles ;
 - 8 close match between donor and recipient / AW ;
 - 9 alleles with strongest rejection / AW, must match ;
 - 10 AVP ; e.g. ref to Class 1 HLA A, B, C
 Class 2 HLA D

4 max

[Total: 18]

Question	Expected Answers	Marks
5 (a)	linked gene may be identifiable / ora ; linked gene may act as a marker / AW gene ; <u>loci</u> are close ; may be inherited together ; AVP ; e.g. low crossover value	1 max
(b)	recessive ; this phenotype is hidden / not expressed in the children / ora ; A F1 generation R ref to allele not present	2
(c) (i)	DdTt ; DTdt ;	2
(ii)	<i>award one mark for each genotype</i> DDTT / DTDT ; DdTt / DTdt ;	2
(d) (i)	$p < 0.001$; R if "<" not given	1
(ii)	1 the <u>difference</u> between the observed and expected results is significant ; 2 occurs by chance qualified ; e.g. < 1 in 1000 cases / very low probability 3 calculated value greater than the critical value ; 4 prediction (of 1 : 1 : 1 : 1) incorrect ; 5 null hypothesis is rejected / AW ; 6 with great confidence / AW ; 7 AVP ;	3 max

continued on next page

Question 5 Expected Answers
cont'd

(iii) *parental genotypes* DdTt ; ddt ;
gametes DT Dt dT dt ; dt ;

5 max if recombinants not identified

mark all these from Punnet square if not stated
allow mark for identifying recombinants anywhere

A *linked alleles together e.g. DTdt*

A *ecf, but 4 max*

	DT	Dt	dT	dt
dt	DdTt	Ddt	ddTt	ddt ;
<i>phenotypes</i>	normal finger normal big toe	normal finger short big toe	long finger normal big toe	long finger short big toe ;
		recombinants identified in some way ;		

OR

	DT	dt	Dt	dT
dt	DdTt	ddt	Ddt	ddTt ;
<i>phenotypes</i>	normal finger normal big toe	long finger short big toe	normal finger short big toe	long finger normal big toe ;

6 max

- 1 crossing over ;
- 2 at chiasma formation ;
- 3 during, meiosis I / prophase I
- 4 allows recombination of alleles / AW ;
- 5 random event / affects only a few chromosomes / AW ;
- 6 parental phenotypes / genotypes, 1:1 ;
- 7 plus a random number of recombinants ;
- 8 fewer recombinants than parental ;

4 max 8 max

[Total: 19]

Question	Expected Answers	Marks
6 (a) (i)	<p>1 suitable for growth (of cells) ;</p> <p>2 contains nutrients / named ;</p> <p>3 contains hormones / oestrogen / FSH ;</p> <p>4 sterile ;</p> <p>5 body temperature / 37°C ;</p> <p>6 correct pH ;</p>	3 max
(ii)	<p>bone marrow ;</p> <p>umbilical cord (blood) ;</p> <p>embryos / foetal germ cells / AW ;</p> <p>AVP ; e.g. cancerous cells / HeLa cells</p>	1 max
(iii)	<p>cells may have mutations ;</p> <p>may pass on, genetic disease / named condition;</p> <p>may be cancerous ;</p> <p>hormones may be unbalanced ;</p>	2 max
(b) (i)	<p>oestrogen (from follicle) ; A secondary oocytes</p> <p>may reverse the changes caused by the menopause ;</p> <p>restart the menstrual cycle / allows menstrual cycle to continue ; R periods</p> <p>AVP ; e.g. detail on menstrual cycle / progesterone from corpus luteum</p>	2 max
(ii)	<p><i>advantages</i></p> <p>A1 may decrease risk of osteoporosis ;</p> <p>A2 may decrease risk of heart disease ;</p> <p>A3 AVP ; e.g. reduces <u>named</u> symptoms</p> <p><i>disadvantages</i></p> <p>D1 timing selected for in evolution / must have a selective advantage / AW ;</p> <p>D2 older cells are less likely to divide accurately / AW / ora ;</p> <p>D3 hormone production may be less regular ;</p> <p>D4 risk of miscarriage higher ; treat refs to fertility as neutral</p> <p>D5 physical demand on older mother ;</p> <p>D6 may increase the risk of breast cancer ;</p> <p>D7 increased risk of, foetal abnormality / named syndrome ;</p> <p style="text-align: right;">3 max for disadvantages</p>	4 max
(c)	<p>HRT ;</p> <p>further details ;</p> <p><u>phytoestrogens</u> ;</p> <p>from plant material ;</p> <p>named e.g. wild yam / soya / beans / germinating seeds / cereal grains ;</p> <p>isoflavones / coumestans / lignans ;</p> <p>antioxidants ;</p> <p>vitamin A / beta-carotene / C / E ;</p>	3 max

continued on next page

Question 6 Expected Answers
cont'd

- (d) defective female gametes / described, could increase frequency ;
R eggs
embryo selection could decrease frequency / AW ;
DNA may be damaged by the technique ;
AVP ;

2 max**[Total: 17]**

Question	Expected Answers	Marks
7 (a) (i)	a collection / group, of symptoms / diseases ; affects many organs / AW ; characteristic of this condition ; Turner's syndrome described (2 symptoms) ;	2 max
(ii)	<i>A marks from a labelled diagram of meiosis I or meiosis II</i> 1 <u>non-disjunction</u> ; 2 of X chromosome in, gamete formation/ meiosis ; 3 no X (in one oocyte / ovum) / ora ; R egg 4 fuses with normal, male gamete / sperm (at fertilisation) ; 5 one X in zygote / foetus ; 6 AVP ; e.g. X0 is classic Turner's syndrome / mosaic Turner's syndrome / 45 chromosomes	4 max
(b) (i)	1 treated with phytohaemagglutinin ; 2 encourages mitosis ; 3 colchicine, stops mitosis / cell division ; 4 prevents spindle formation ; 5 dilute salt solution / absorb water by osmosis ; 6 swell to spread chromosomes / stained ; 7 photographed <u>and</u> cut out to arrange in pairs ; 8 AVP ; e.g. according to size / forms karyotype	3 max
(ii)	chromosomes may be changed in number or shape ; R easier to see usually produce physical / visible defects, in foetus / many structures affected ; karyotypes are simple to produce ; gene probes not available for all mutations ;	2 max

continued on next page

Question 7 Expected Answers
cont'd

(c) dilemma as to whether to have the tests ;
may not want to know ;

whether the relatives of the affected individual should be told ;
could affect their lives / AW ;

whether a pregnancy should be terminated ;
qualification ; e.g. destroying a life

stigma may be attached to the test ;
e.g. insurance / mortgage ;

AVP ; e.g. false positive
degree of disability not clear / AW

AVP ; e.g. partner may be involved
may not agree

4 max

[Total: 15]

**Advanced GCE Human Biology (3886 / 7886)
June 2007 Assessment Series**

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	entry
2856	Raw	60	40	35	30	25	20	0	1512
	UMS	90	72	63	54	45	36	0	
2857	Raw	60	45	39	33	28	23	0	2115
	UMS	90	72	63	54	45	36	0	
2858A	Raw	120	91	79	67	55	43	0	2049
	UMS	120	96	84	72	60	48	0	
2858B	Raw	120	91	79	67	55	43	0	81
	UMS	120	96	84	72	60	48	0	
2866	Raw	90	66	57	48	40	32	0	561
	UMS	90	72	63	54	45	36	0	
2867	Raw	120	81	71	62	53	44	0	828
	UMS	120	96	84	72	60	48	0	
2868	Raw	90	72	64	56	48	40	0	824
	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	3.8	15.0	34.2	59.0	83.6	100.0	1756
7886	6.0	22.1	46.6	74.7	95.2	100.0	828

3886

1756 candidates aggregated this series

7886

828 candidates aggregated this series

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication

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