

Human Biology

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

Mark Schemes for the Units

January 2009

3886/7886/MS/R/09J

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

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 Subsidiary GCE Human Biology (3886)

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General advice to Assistant Examiners on the procedures to be used

YOU WILL BE REQUIRED TO UNDERTAKE 10 PRACTICE AND 10 STANDARDISATION SCRIPTS BEFORE STARTING TO MARK LIVE SCRIPTS.

1. The schedule of dates for the marking of this paper is very important. It is vital that you meet these requirements. If you experience problems then you must contact your Team Leader (Supervisor) without delay.
2. An element of professional judgement is required in the marking of any written paper. Candidates often do not use the exact words which appear in the detailed sheets which follow. If the science is correct and also answers the question then the mark(s) should normally be credited. If you are in doubt about the validity of any answer then consult your Team Leader (Supervisor) by phone, the messaging system within SCORIS or e-mail.
3. Correct answers to calculations always gain full credit even if no working is shown. (The 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
4. Some questions may have a 'Level of Response' mark scheme. Any details about these will be in the rationale.
5. If an answer has been crossed out and no alternative answer has been written then mark the answer crossed out.
6. In addition to the award of 0 marks, there is a NR (No Response) option on SCORIS.

Award 0 marks

- if there is any attempt that earns no credit (including copying out the question or some crossed out working)

Award NR (No Response)

- if there is nothing written at all in the answer space
OR
- if there is any comment which does not in any way relate to the question being asked (e.g. 'can't do', 'don't know')
OR
- if there is any sort of mark which is not an attempt at the question (e.g. a dash, a question mark)

7. Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
not	= answers which are not worthy of credit
reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant
allow	= answers that can be accepted
()	= words which are not essential to gain credit
—	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording
ora	= or reverse argument

8. Annotations: the following annotations are available on SCORIS.

✓	= correct response
✗	= incorrect response
bod	= benefit of the doubt
nbod	= benefit of the doubt not given
ECF	= error carried forward
^	= information omitted
I	= ignore
R	= reject

Highlighting is also available to highlight any particular points on the script.

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text:

9. The Comments box

The comments box will be used by your PE to explain their marking of the practice scripts for your information. Please refer to these comments when checking your practice scripts. You should only type in the comments box yourself when you have an additional object of the type described in Appendix B of the Handbook for Assistant Examiners and Subject Markers.

Please do not use the comments box for any other reason.

Any questions or comments you have for your Team Leader should be communicated by phone, SCORIS messaging system or e-mail.

10. Please send a brief report on the performance of the candidates to your Team Leader (Supervisor) by the end of the marking period. The Assistant Examiner's Report Form (AERF) can be found on the Cambridge Assessment Support Portal. This should contain notes on particular strengths displayed, as well as common errors or weaknesses. Constructive criticisms of the question paper/mark scheme are also appreciated.

2856 Blood, Circulation and Gaseous Exchange

Question			Expected Answers	Marks	Additional Guidance																				
1	(a)		sterile equipment used / skin swabbed with alcohol / person taking sample wears gloves / AW ; prevents spread of infection / AW ; use of tourniquet ; named site for inserting syringe e.g. upper arm around elbow ; blood taken from, vein / artery (in wrist) ;	3 max	ACCEPT disinfect ACCEPT phonetic spelling of tourniquet																				
	(b)		<table><tr><td></td><td>red blood cells</td><td>macrophages</td><td>prothrombin and fibrinogen</td><td></td></tr><tr><td>whole blood</td><td>✓</td><td>✓</td><td>✓</td><td>;</td></tr><tr><td>plasma</td><td>✗</td><td>✗</td><td>✓</td><td>;</td></tr><tr><td>serum</td><td>✗</td><td>✗</td><td>✗</td><td>;</td></tr></table>		red blood cells	macrophages	prothrombin and fibrinogen		whole blood	✓	✓	✓	;	plasma	✗	✗	✓	;	serum	✗	✗	✗	;	3	<i>mark rows not columns</i>
	red blood cells	macrophages	prothrombin and fibrinogen																						
whole blood	✓	✓	✓	;																					
plasma	✗	✗	✓	;																					
serum	✗	✗	✗	;																					
	(c)	(i)	(they have) anaemia / post operative treatment / major blood loss / treatment for named disease e.g. leukaemia ;	1	ACCEPT low blood cell count																				
		(ii)	water potential of distilled water, higher / less negative, (than cells) ; water enters (red) cells ; by osmosis ; through partially permeable membrane ; down a water potential gradient ; causing cells to swell / burst ;	4 max	<i>ora applies</i> DO NOT CREDIT semi-permeable membrane DO NOT CREDIT concentration gradient																				

Question			Expected Answers	Marks	Additional Guidance
	(d)		small / $\approx 8\mu\text{m}$ / narrow, <u>diameter</u> ; walls, thin / single cell thick / $\approx 0.5\mu\text{m}$; (walls made of) flattened cells / endothelial cells ; (walls have) vesicles / pores / AW ; (walls have) gaps between cells ;	3 max	ACCEPT answers that imply small diameter e.g. reference to passage of blood cells ACCEPT epithelial / thin cells – DO NOT CREDIT epithelium
			Total	14	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	B neutrophil ; C lymphocyte ; F (squamous) epithelial ;	3	ACCEPT endothelial / squamous cell
		(ii)	X cilia ; Y chloroplast / granum ;	2	ACCEPT stroma
	(b)		<u>biconcave</u> disc ; flexible (can squeeze through capillaries) ; no, nucleus / organelles ; packed with haemoglobin ;	2 max	
	(c)		6.67 : 1 ;; <i>one mark for</i> 12 000 ÷ 1800 ; incorrect 'rounding' e.g. 6.66 : 1 ; inappropriate number of decimal places ;	2 max	ACCEPT 6.7 : 1 / 6.667 : 1
			Total	9	

Question			Expected Answers	Marks	Additional Guidance
3			globular ; amino acid ; condensation ; four ; quaternary ; primary ; four ; iron ;	8	ACCEPT quaternary
Total				8	

Question			Expected Answers	Marks	Additional Guidance
4			1 carcinogens / DNA damage / cause mutations ; 2 tumour / cancer in, trachea / lung ; 3 ref. to COPD ; 4 emphysema ; 5 neutrophils collect in the lungs ; 6 secrete, an enzyme / elastase ; 7 breaks down elastin / loss of elasticity ; 8 (walls of) alveoli break down ; 9 reduction in surface area ; 10 chronic bronchitis ; cilia damaged ; 11 goblet cell , activity / number, increased ; 12 more mucus present ; 13 bronchioles / airways, inflamed ; 14 scar / fibrous tissue , builds up ; 15 more bacterial growth / more infections ; 16 ref. to onset of asthma ; 17	8 max	<p>ACCEPT throat – DO NOT CREDIT mouth</p> <p>DO NOT CREDIT cilia ‘die’</p>
			QWC – Award this mark for the correct use of three emboldened terms. carcinogens, mutations, tumour, trachea, COPD, emphysema, neutrophils, elastase, elastin, alveoli, bronchitis, cilia, goblet cell, mucus, bronchioles, fibrous tissue, asthma	1	
			Total	9	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	Q <u>saturated</u> triglyceride ; R phospholipid ; S glycolipid ;	3	
		(ii)	<i>molecule P</i> contains a double bond ; between two carbons (atoms) ; changes bond angles / AW ;	2 max	<i>ora</i> for molecule Q
	(b)		HDL to LDL ratio is best indicator of risk ; lipoproteins / LDL / HDL, transport cholesterol ; LDLs transport, from liver / to arteries ; LDLs cause deposition (of cholesterol) <u>in</u> artery walls ; high LDL concentration increases risk ;	3 max	<i>ora</i> for HDLs <i>ora</i> for HDLs <i>ora</i> for HDL
			Total	8	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		muscle ;	1	
	(b)		enzymes are specific ; due to tertiary structure ; <u>active site</u> complementary to intermediate / AW ; intermediate binds to active site ; (forms) <u>ES complex</u> (with intermediate) ; glucose is different shape to intermediate ; (therefore) does not, fit active site / form ES complex ;	4 max	
	(c)	(i)	little increase in rate, at low concentrations / from 0 to 3 a.u. ; rapid / steep, increase in rate from 3 to 7 a.u. ; little increase / levelling off, in rate from 7 to 10 a.u. ; overall increase in rate from <u>0 to 10</u> a.u. ; figs. to support ; <i>comparative glycogen formation rates for two specified intermediate concentrations</i>	3 max	
		(ii)	all active sites occupied / maximum number of ES complexes (at any time) ; all enzymes at maximum turnover rate / AW ; substrate concentration is not a limiting factor / enzyme concentration is limiting ;	2 max	

Question			Expected Answers	Marks	Additional Guidance
	(d)		Glucose converted so..... glucose concentration inside cells, will decrease / remains low ; concentration gradient maintained / AW ; rate of diffusion maintained;	2 max	ACCEPT ora 'glucose not converted so'
			Total	12	

2857 Growth, Development and Disease

Question			Expected Answers	Marks	Additional Guidance
1	(a)		lung cancer cells / ora keep dividing ; not specialised for a function ; abnormal shape ; spread to other parts of the body ;	3 max	DO NOT ACCEPT rapid growth or divide rapidly CREDIT different shape
	(b)	(i)	short wave length radiation ; passes through lung tissue ; onto photographic paper / produce image ; cancer denser than normal tissue ; blocks more radiation ; appears as a, white patch / shadow on radiograph ;	3 max	ACCEPT correct ref to CT using x-rays to produce image DO NOT ACCEPT forms a picture
		(ii)	surgery ; chemotherapy ; radiotherapy ; immunotherapy ;	2 max	
	(c)		much higher incidence of lung cancer in smokers compared to non-smokers ; increase in incidence of lung cancer with increase in amount of smoking ; AVP ;	2	e.g. higher incidence of lung cancer in passive smokers less incidence of lung cancer in smokers who have given off
			Total	10	

[illegible]

Question			Expected Answers	Marks	Additional Guidance
3	(a)		no anti-HIV antibodies until 3-4 months after infection ; level of antibodies rises sharply between 3/4 and 12 months ; takes time for, clonal selection / clonal expansion, to occur / AW ; then plasma cells produce antibodies at a very fast rate ; pairs of comparative figures to support ;	4 max	ACCEPT a small peak within the first 3 months ACCEPT 'takes time for plasma cells to be produced'
	(b)	(i)	1 960 000 ; ; 0.08 x 24 500 000 ;	2 max	2 marks for correct answer 1 mark for correct method but mistake in arithmetic
		(ii)	<i>ora</i> smaller proportion of AIDS sufferers in Sub-Saharan Africa are men (compared to women) ; higher proportion of AIDS sufferers in Sub-Saharan Africa are women ; higher proportion of AIDS sufferers in Sub-Saharan Africa are children ;	2 max	ACCEPT 'smaller proportion of AIDS sufferers are men in Sub-Saharan Africa are men compared to USA' <i>ora</i> ACCEPT 'higher proportion of AIDS sufferers in Sub-Saharan Africa are women compared to USA' <i>ora</i> ACCEPT 'Higher proportion of children that are AIDS sufferers in Sub-Saharan Africa compared to USA'
		(iii)	less homosexual transmission ; more heterosexual transmission ; more transmission from mother to child ;	2 max	DO NOT ACCEPT more homosexuals, must be with reference to relationship / transmission

Question			Expected Answers	Marks	Additional Guidance
	(c)		many people not, diagnosed / tested ; incorrect diagnosis ; number of cases not reported accurately ;	2 max	ACCEPT 'people don't know they have it' ACCEPT inadequate screening ACCEPT example of inaccurate reporting/recording;
			Total	12	

Question			Expected Answers	Marks	Additional Guidance
6	(a)	(i)	change in DNA ; change in a base (pairs) ; deletion / substitution / insertion ;	3	DO NOT CREDIT ref to polypeptide CREDIT example such as G instead of A CREDIT a description
		(ii)	ionising radiation ; UV light ; X-rays ; gamma radiation ; carcinogen(s) / named ; ageing ;	2 max	DO NOT CREDIT radiation unqualified e.g. mustard gas
	(b)		gene for beta (β) haemoglobin ; change in DNA codon ; change in RNA codon ; different, tRNA / anticodon ; complements altered RNA codon ; different amino acid inserted into polypeptide chain ; R group has different properties ; polypeptide chain folds up differently ; haemoglobin molecule has different properties ;	4 max	IGNORE ref to substitution CTT to CTA GAA → GAU CUU → CUA valine substituted for glutamate/glutamic acid e.g. hydrophilic to hydrophobic, valine is hydrophobic ACCEPT change in <u>tertiary</u> structure DO NOT CREDIT 'change in shape' or reference to red blood cell
			Total	9	

2858/01 Case Studies

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	infectious ;	1	CREDIT contagious ACCEPT 'infection'
		(ii)	AIDS ; HIV (virus) ;	2	DO NOT CREDIT any reference to TB DO NOT CREDIT bronchitis ACCEPT alternative infectious diseases such as malaria ACCEPT alternative correctly identified pathogen such as plasmodium ACCEPT HIV/AIDS for name of disease DO NOT CREDIT AIDS for name of pathogen DO NOT CREDIT HIV for name of disease
	(b)	(i)	57 ;;	2	ACCEPT 56.67 or 56.7 Two marks for correct answer even if no working or incorrect working shown. If answer is incorrect, not rounded or incorrectly rounded, then allow 1 mark for correct working e.g. 85 / 1500 If measurement is incorrect (e.g.84 or 86) allow 1 mark for error carried forward if calculation is correct e.g 56 or 57.3 or 57.33

Question			Expected Answers	Marks	Additional Guidance
		(ii)	(bacterial cell has) no, membrane bound organelles / named organelle ; further example of named organelle ; circular DNA ; plasmids ; smaller ribosomes ; capsule ; peptidoglycan / murein , cell wall ; mesosome ; flagella ; no histones (attached to DNA) ; (DNA has) no introns ;	3 max	ACCEPT nucleus, RER, mitochondria, lysosome ACCEPT 70s, 20 <u>nm</u> (prokaryotic) not 22 <u>nm</u> (eukaryotic) DO NOT ACCEPT 'cell wall' DO NOT ACCEPT cilia ACCEPT 'naked' DNA
	(c)	(i)	chest pain ; coughing up blood ; coughing up sputum ; weakness / fatigue / tiredness ; weight loss ; (night)sweats / fever ; breathless / AW ; loss of appetite ;	2 max	DO NOT ACCEPT paleness ACCEPT phlegm or mucus
		(ii)	(to take) X – rays ; (of) chest / lungs ; (TB) shows as cloudy / AW , areas ; passes X – rays / AW on , to consultant ;	2 max	ACCEPT other details of how diseased area is distinguished if technique given is not X-ray (error carried forward)

Question			Expected Answers	Marks	Additional Guidance
	(d)		<p>1 named type of drug ;</p> <p>2 named drug ;</p> <p>3 example of misuse by patient ;</p> <p>4 reference to long treatment time ;</p> <p>5 example of mismanagement ;</p> <p>6 failure to implement DOTS / AW ;</p> <p>7 ref to variation in sensitivity to drug ;</p> <p>8 ref to cause of variation OR mutation ;</p> <p>9 ref to selection pressure ;</p> <p>10 resistant bacteria survive ;</p> <p>11 (resistant bacteria) multiply ;</p> <p>12 genes/alleles , for resistance passed on ;</p>	6 max	<p>ACCEPT antibiotic OR sulphonamide</p> <p>ACCEPT rifampin OR isoniazid OR pyrazinamide</p> <p>ACCEPT failure to complete the course / not taking at set times</p> <p>ACCEPT 6 – 9 months OR over a year</p> <p>ACCEPT over-prescription OR wrong antibiotic</p> <p>ACCEPT reference to failure of any aspect of DOTS such as supervised taking of treatment or standardised provision of treatment e.g. 'no-one watches patient taking the drug'</p> <p>DO NOT CREDIT 'immune' bacteria</p> <p>ACCEPT reverse argument e.g. susceptible bacteria die</p> <p>DO NOT CREDIT 'resistance passed on'</p>
	(e)		<p>(rate) expressed per, fixed number of people ;</p> <p>population has increased ;</p> <p>number of new cases is less than the population growth / AW ;</p>	2 max	<p>CREDIT per 100 000 people or any given population size</p> <p>ACCEPT 'figures given are incidence / prevalence'</p>

Question			Expected Answers	Marks	Additional Guidance
	(f)		(TB is an) <u>opportunistic</u> infection ; (HIV) virus destroys the immune system ; ref to T- helper cells destroyed ; fewer / AW , B cells stimulated ; fewer / AW , antibodies produced ; fewer / AW , types of , antibody produced ; killer T- cells not stimulated ; reference to effect of social factors ;	3 max	ACCEPT weakens immune system OR general comment about white blood cells not working ACCEPT lymphocytes instead of cells throughout ACCEPT reference to poverty or poor housing among AIDS victims
			Total:	23	

Question			Expected Answers	Marks	Additional Guidance								
2	(a)	(i)	stethoscope ;	1	ACCEPT phonetic spelling								
		(ii)	sphygmomanometer ;	1	ACCEPT phonetic spelling								
	(b)	(i)	<table><tr><td>red blood cell</td><td>D ;</td></tr><tr><td>squamous epithelial cell</td><td>A / B ;</td></tr><tr><td>highest /least negative water potential</td><td>C ;</td></tr><tr><td>lowest / most negative water potential</td><td>F ;</td></tr></table>	red blood cell	D ;	squamous epithelial cell	A / B ;	highest /least negative water potential	C ;	lowest / most negative water potential	F ;	4	
red blood cell	D ;												
squamous epithelial cell	A / B ;												
highest /least negative water potential	C ;												
lowest / most negative water potential	F ;												
		(ii)	water moving from , alveoli into capillary ; blood diluted / haemodilution ; haemolysis / will happen ; <div>1max</div> fresh water has, higher / less negative , water potential ;	2 max	ACCEPT reference to diagram (F to C) ACCEPT water potential higher / less negative in alveoli OR water potential lower / more negative in capillary OR fresh water has higher / less negative, water potential than sea water								
		(iii)	E ; reduces / AW , surface tension ; prevents alveoli collapsing ; (surfactant) reduces hydrogen bonding ; <div>2 max</div>	3 max	ACCEPT prevents alveoli sticking together DO NOT ACCEPT prevents lungs collapsing / sticking								

Question			Expected Answers	Marks	Additional Guidance
	(c)	(i)	diffusion ; from , named region of high concentration ; to, named region of low concentration ; until equilibrium (when blood is leaving) ; due to random motion (of gas molecules) ;	3 max	ACCEPT from alveoli for oxygen OR from blood for carbon dioxide ACCEPT blood for oxygen OR alveoli for carbon dioxide
		(ii)	(alveoli damage leads to) reduced surface area (for gas exchange) ; less, oxygen diffusing in / AW ; less , oxygen being transported ; less , ATP produced ; (due to) less <u>aerobic</u> respiration ;	2 max	ACCEPT less oxygen getting into blood or in blood ACCEPT less oxygen getting to muscles or carried
	(d)		emphysema / named disease ; <i>1 mark</i> elastic fibres broken down ; ref to neutrophils ; release , enzyme / elastase ; lack of enzyme inhibitor ; alveoli over inflate ; AVP ;; <i>2 marks</i>	3 max	ACCEPT COPD / TB / lung cancer / cystic fibrosis DO NOT ACCEPT pulmonary oedema DO NOT CREDIT loss of elasticity CREDIT elastin broken down CREDIT macrophage CREDIT valid explanation of alternative named disease e.g. (lung cancer) as cancer cells are unspecialised and have no elastic fibres would get 2 marks.

Question			Expected Answers	Marks	Additional Guidance
	(e)		ref to patient position ; (use) <u>defibrillator</u> ; electrode connections are checked ; skin area is dried ; pads / AW ; placed on chest ; (electric) shock given ; CPR maintained between shocks ; victim placed in recovery position (if breathing starts) ;	3 max	IGNORE references to shaving chest
			Total:	22	

2866 Energy, Control and Reproduction

Question			Expected Answers	Marks
1	(a)	(i)	<p><i>Only mark first answer on each of the numbered sections unless candidate has put both answers in section 1 and section 2 is left blank.</i></p> <p>1 check whether the woman is pregnant ; 2 stage of, ovulation / menstrual cycle / AW ; 3 check normal <u>development</u> of follicles / AW ; 4 assurance that ovaries are normal / AW ; 5 check no disease present / AW ; A (ovarian) cancer R cervical cancer</p>	2 max
		(ii)	<p>1 x-rays are a form of radiation / ultrasound uses only sound waves / AW ; A ionising radio waves 2 x-rays may cause cancer ; 3 x-rays are a mutagen / AW ; 4 ultrasound is safer for repeated use ; BOD x-rays can harm the unborn foetus A ora 5 definition of soft tissue is not good with x-rays / AW ; BOD gives better / clearer image A ora</p>	2 max
	(b)	(i)	<p>12.2 (mm) ;; A 11.7 – 12.6</p> <p><i>If answer incorrect or not to one decimal place, allow one mark for:</i></p> <p><u>28 (measured size from A to B)</u> A 27 – 29 mm 2.3</p>	2 max
		(ii)	<p>link between size of follicles and ovulation ; size of follicle may relate to ovulating more than once / AW ; R size related to healthy ova / egg a large follicle produces enough, oestrogen / AW ; to, stimulate LH production / produce a surge / stimulate ovulation / AW ;</p>	2 max

Question			Expected Answers	Marks
	(c)	(i)	increases / doubles, the chances of getting pregnant / multiple pregnancy ; (since) two oocytes available for fertilization ; (results in) <u>fraternal</u> / <u>dizygotic</u> / <u>non-identical</u> , twins ; AVP ; e.g. ref. to different gestational age (of twins) treat vanishing twin syndrome as neutral	2 max
		(ii)	women have, finite number, of oocytes / AW ; A if reasonable number (1-10 million) present from birth / AW ; (increased ovulation means) oocytes are used up more quickly / AW ; (eventually) run out of (viable) oocytes / AW ; AVP ; e.g. less oestrogen produced	2 max
		(iii)	repeat it ; use a larger sample (of women) ; increase length of study / AW ; more exact definition of a mature follicle ; eliminate, other variables / named ; e.g. <i>lifestyle factors</i> R ref. to changing age group	2 max
	(d)		<i>Only mark first answer if more than one answer is given.</i> could control, length of woman's reproductive life / how long fertile ; A ora (delay menopause) could help women who do not ovulate / could induce ovulation / AW ; could prevent <u>early</u> menopause ; possibility of gene therapy ; A correct ref. to manipulating gene AVP ; e.g. possibility of interference mRNA / AW	1
			Total:	22

Question			Expected Answers	Marks
2	(a)		<p>Ignore ref. to death (high) glucose / oxygen, demand ; A ora e.g. so don't get deprived of oxygen high, metabolic rate / rate of (aerobic) respiration ; need to remove, metabolic waste / AW ;</p> <p>AVP ; e.g. ref. to deteriorating levels of consciousness / coma e.g. glucose the only respiratory substrate</p>	2 max
	(b)		<p>an automatic response ; A involuntary / unconscious (controlled by) sympathetic <u>and</u> parasympathetic nerves ; (which) produce opposite effects / AW ; A ref. to fight / flight and rest / digest examples of above ; e.g. sympathetic stimulation ↑ BP, para ↓ BP</p>	2 max
	(c)	(i)	<p>R arteries / blood vessels for 1st mention but treat as ecf for rest of question</p> <p>1 high pressure of blood damages the <u>walls</u> of arterioles ; A lining / endothelium</p> <p>2 phagocytes / macrophages, invade ; 3 stimulates multiplication of cells in wall ; 4 deposition of, cholesterol / atheroma (in arteriole wall) ; A (fatty) plaque /ref. to foam cells</p> <p>5 (leads to) hardening / thickening, of (arteriole) walls ; 6 increases clotting ; 7 clots may break off ; 8 high blood pressure / atherosclerosis, may rupture capillary ;</p>	4 max
	(c)	(ii)	<p>Mark the first two answers only</p> <p>R high blood pressure</p> <p>obesity ; high salt diet ; diet high in <u>saturated</u> fat ; lack of exercise ; smoking ; AVP; e.g. septicaemia or high alcohol consumption or high blood cholesterol level e.g. stress or old age / ageing or diabetes or males at higher risk</p>	2 max

Question			Expected Answers	Marks
	(d)	(i)	1 detail of patient preparation before scan ; e.g. strapped down / asked to stay still 2 head is X-rayed ; <i>need ref. to head / brain at some point in answer for this mark</i> 3 from many different angles ; 4 different structures absorb different amounts of radiation ; 5 three dimensional picture produced ; A detailed picture of brain 6 (x-ray opaque) dyes may be used ; A contrast 7 AVP ; e.g. ref to risk of X-rays	3 max
		(ii)	location / extent of damage ; type of damage (haemorrhage or clot) ; progression of damage over time / AW ; AVP ; e.g. visual / pictorial record e.g. helps doctors to decide on appropriate treatment / therapy	2 max
	(e)	(i)	cerebellum A ; cerebral cortex C / D / F ; medulla oblongata E ; hippocampus D ;	4
		(ii)	(strokes) damage / kill, neurones / nerves ; (damaged) neurones cannot easily re-grow / AW ; A regenerate (because) scar tissue may form in damaged area ; axons / nerves, cannot grow through scar tissue ; AVP ; e.g. chemicals which encourage repair may damage brain e.g. ref. to enzymes e.g. nerve growth factors	2 max
			Total:	21

Question			Expected Answers	Marks
3	(a)	(i)	X – respiration ; Y – photosynthesis ;	2
		(ii)	<i>Answers must be relevant to Fig. 3.1 and relate to human activity</i> A AW and ora throughout Mark 1 st answer only deforestation ; increasing CO ₂ / less CO ₂ removed from atmosphere ; OR eating cattle ; not returning waste to ecosystem ; OR use of fossil fuel ; increasing CO ₂ ; OR use of, fertiliser / pesticides ; destroying decomposers (dehydration by osmosis) ; OR water-logging / described ; reduces oxygen for micro-organisms ; OR biofuel ; increasing CO ₂ ; OR AVP ;; e.g. any suitable method named example e.g. effect on cycle	2 max
	(b)	(i)	1 maize is a <u>producer</u> ; 2 absorbs light / energy from the sun ; 3 (and) CO ₂ (from the atmosphere) ; 4 converts it into, chemical energy / named ; R ref. to making energy 5 by photosynthesis ; 6 (maize) eaten by cattle / primary consumers ; A named organic compound in maize 7 ref. to decomposers / recycling of carbon ; Have to be referring to carbon, not oxygen etc.	3 max
		(ii)	1 decomposers are micro-organisms ; A bacteria 2 break down / respire, organic waste / named ; A urine / nutrients 3 (decomposers) respire aerobically / anaerobically ; 4 return CO ₂ to environment / CO ₂ released ; R makes CO ₂ 5 keep (carbon) cycle going / AW ; 6 therefore, large numbers of decomposers required in the cycle ; 7 AVP ; e.g. named examples of decomposers	3 max

Question			Expected Answers	Marks
	(c)		<p>113.8 OR 121.4 ;;</p> <p><i>if answer incorrect or not to one decimal place, allow one mark for:</i></p> $\frac{310 - 145 \text{ (A 140-145)}}{145 \text{ (A 140-145)}} \times 100$ <p>If answer is in between 113.8 and 121.4, look at working. Give 2 marks if correct working using figures within the range given</p>	2 max
	(d)		<p>DESCRIBE</p> <p>in all countries fertiliser application is higher in 1995 ; in China application has risen (continuously) from 1980 to 1995 ; dropped in, UK / Ecuador, in 1990 ; UK has highest rate of application / Ethiopia has lowest rate of application ; rate of increase / AW, in Ecuador has increased since 1990 ; comparative figs from both axes to support trends ; comparative figs from both axes to support trends ;</p> <p>EXPLAIN</p> <p><u>intensive</u> farming in, China / UK ; <u>extensive</u> farming in, Ecuador / Ethiopia ; high / low, input of fertiliser ; <i>correctly applied to statement above</i> intensive farming allows higher, crop yield / density grazing cattle ; A ora ref. to level of technology in named country ; ref. to wealth of named country ; A correct ref. to gross national product (GNP) ref. to availability of land in named country ; ref. to increasing population, overseas aid ;</p>	<p>4 max</p> <p>7 max</p>
			<p>QWC - legible text with accurate spelling, punctuation and grammar ;</p> <p><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></p>	1
			Total:	20

Question			Expected Answers	Marks
4	(a)		breaking / lysis, of glycosidic bonds ; hydrolysis / described ; ref. to enzyme action ; R wrong enzyme AVP ; e.g. glycogen into, intermediate product e.g. ref. to 1-4 / 1-6 glycosidic links	2 max
	(b)	(i)	makes glucose more reactive / AW ; A correct ref. to high energy bonds so that, next step(s) / named step(s), occur / AW ; AVP ; e.g. to maintain an, electrochemical / diffusion gradient	1 max
		(ii)	2 ;	1
	(c)		1 enzymes lower activation energy ; 2 allow reactions to occur at body temperature ; 3 without enzymes heat energy required would damage cells ; 4 without enzymes reaction would be too slow ; A ora (enzymes speed up reactions) 5 correct ref to denaturing cell proteins ; 6 AVP ; e.g. ref. to providing alternative pathways	3 max
	(d)		reduced NAD passed to electron transfer chain / AW ; A correct ref. to oxidative phosphorylation hydrogen (atoms) split into, protons / H^+ , and electrons ; electrons travel through the electron transfer chain / AW ; A ETC / proton TC electrons release energy (as they pass down) ; to convert ADP into ATP ; A form (more) ATP / recycle ATP AVP ; e.g. chemiosmosis / described	3 max
	(e)		active transport ; from an area of low conc. to and area of high conc. ; via carrier proteins in membranes ; uses ATP ; A energy AVP ; ref. to intrinsic proteins	2 max
Total:				12

Question			Expected Answers	Marks
6	(a)	(i)	endometrium / described, present in / blocks, oviducts ; A fallopian tubes prevents implantation ; prevents, ova and sperm meeting / fertilisation ;	2 max
		(ii)	mark first answer if refer to oviducts in 6 (a)(i), do not need to say 'oviducts' for mp1 here surgery to, unblock oviducts / remove endometrial tissue from oviducts ; dilation and curettage / D&C / AW ; IVF ;	1 max
	(b)		ovulatory / hormonal, disorder ; e.g. polycystic ovaries antisperm antibodies ; uterine factors ; oviduct blockage (caused by bacterial infection) ; ovarian cancer ; R cervical R menopause / hysterectomy	2 max
	(c)	(i)	(allows time for) donor to be tested / screened for infectious diseases ; that may take time to show up ; e.g. hepatitis / HIV ; donor tested, at regular intervals / several times ;	2 max
		(ii)	prevents movement of <u>water</u> / has the same water potential / AW ; ref. <u>osmosis</u> ; which would cause them to burst / shrivel / AW ; maintains ionic balance ;	3 max
Total:				10

2867 Genetics, Homeostasis and Ageing

Question			Expected Answers	Marks
1	(a)	(i)	number of people in a population (with disease) ; in a given time ; (usually) develops slowly / AW ; chronic disease lasts for a long time ; may be degenerative / AW (in ageing population) ;	3 max
		(ii)	baboon not <u>genetically</u> compatible ; <u>tissue types</u> different / <u>tissue types</u> must match ; (baboon cell surface has) foreign protein / antigen ; ref to HLA / Human Leucocyte Antigen / MHC complex ; T lymphocytes / 'killer' cells attack / destroy, (cells of) donated organ ; immunosuppressant drugs not used ;	3 max
	(b)	(i)	<i>genus</i> a group of similar <u>species</u> ; some characteristics in common ; next hierarchical group up from species / AW ; <i>species</i> a group of <u>similar</u> organisms / AW ; same number of chromosomes ; share the same gene pool ; interbreed to produce fertile young / ora ; genetically / reproductively, isolated ;	3 max
		(ii)	humans are, also primates / closely related ; some features in common ; of similar size ;	2 max
	(c)	(i)	X and W ;	1
		(ii)	<i>accept ora for all</i> <i>W fraternal twin</i> have, 1 in 4 / 0.25 / 25%, chance of having both haplotypes in common / AW ; 1 in 2 / 0.5 / 50%, chance of having one haplotype in common / AW ; <i>1 max</i> <i>X identical twin</i> formed from <u>same</u> zygote ; genetically identical (to sibling) / AW ; <i>1 max</i> <i>Y genetically engineered pig</i> cells have no, antigens, which provoke rejection ; <i>1 max</i> <i>Z mother or father</i> will have one haplotype in common with either parent / AW ; <i>1 max</i>	4 max

Question			Expected Answers	Marks
2	(a)	(i)	<u>ultrafiltration</u> ;	1
		(ii)	10 000 ;; <i>If answer incorrect or to an inappropriate degree of accuracy, allow one mark for:</i> <u>image measurement (15 mm)</u> 1.5 µm	2
		(iii)	1 projecting 'fingers' / AW 2 of <u>podocytes</u> ; 3 wrap around capillaries of glomerulus ; ACCEPT diagram / labels on Fig. 2.1 4 (podocytes) present on wall of capsule ; 5 increase the surface area ; 6 gaps / AW, between 'fingers' for filtration ; 7 role of basement membrane qualified ; 8 selectively permeable / selective barrier ; 9 to retain molecules, of a certain size / size stated ;	5 max
	(b)	(i)	a substance which does not <u>react</u> (in the body) / AW ; not, used / metabolised ;	1 max
		(ii)	160 ;; <i>If answer incorrect, allow one mark for:</i> <u>120 x 2</u> 1.5	2

Question			Expected Answers	Marks
		(iii)	<p><i>assume answers refer to glomerular filtrate if not qualified accept ora throughout</i></p> <p>no cells ; ACCEPT erythrocytes / leucocytes no platelets ; no, large proteins / proteins above 65 000 – 69 000 (RMM) ; ACCEPT any in range increased urea concentration ;</p>	2 max
	(c)		<p><i>effect</i> GFR would increase / AW ;</p> <p><i>explanation</i> (dilation of the afferent arteriole) increases blood flow (into glomerulus) ; blood pressure (in the glomerulus) rises ; because diameter of efferent arteriole does not change / AW ; 2 max <i>allow max 1 for ecf in explanation relating to incorrect effect</i></p>	3 max
	(d)		haemoglobin molecules are within erythrocytes ; ACCEPT red blood cells	1
			Total:	17

Question			Expected Answers	Marks
3	(a)	(i)	it is passed on from one generation to another / AW ;	1
		(ii)	may occur as (spontaneous) mutation ; may be in somatic cells / AW ; may cause infertility / AW ; may, shorten life / be lethal ;	2 max
		(iii)	pedigree analysis / AW ; (occurs) over <u>several</u> generations / AW ; should show, a visible chromosomal abnormality / a characteristic biochemical abnormality, in all individuals with condition / AW ; ref to DNA profiling qualified ;	2 max
	(b)		1 the disease is inherited ; 2 it occurs in two / AW, generations of your family ; 3 only affects males ; 4 sex linked / on X chromosome ; 5 recessive (allele) because is not expressed in female ; 6 he inherited it from his mother / his mother is a carrier ; 7 only females can / needs two X chromosomes to, be carriers ; 8 his sons will not inherit it from him / AW ; 9 <u>all</u> his daughters will carry it ; 10 need to test partner to check she is not a carrier ; 11 (if she is) sons could inherit the disease ; 12 (if she is) his homozygous recessive daughters will die, in utero / at puberty / AW ; 13 the decision is his / geneticist's role is only to inform him / may suggest IVF ;	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
	(c)	(i)	less chance of , infection / named blood born e.g. HIV ; larger supply of Factor VIII ; more regular supply ; purified / more concentrated / concentration more accurate ;	2 max
		(ii)	Factor VIII is broken down (in the body) ; Factor VIII filtered out by kidneys ; Factor VIII can not be made ; bleeding as a result of an accident is not predictable / AW ; (injection) maintains a stable concentration ; (when a capillary is ruptured) normally releases clotting response / AW ;	3 max
Total:				18

Question			Expected Answers	Mark s
4	(a)		negative feedback ; maintains a constant internal environment / ref to narrow limits ; <u>oscillation</u> around the set point / AW ; receptors detect change ; in internal or external environment ; relayed to effectors ;	3 max
	(b)		1 negative feedback ; 2 maintains, set point / norm / normal glucose concentration ; 3 e.g. 70 – 100 mg per 100 cm³ blood ACCEPT figure within range ; 4 (location of α or β cells in) Islets of Langerhans ; 5 target cells (mainly) in, liver / muscle cells / adipose tissue ; 6 as blood glucose concentration rises, detected by β cells ; 7 secrete insulin ; 8 decreases blood glucose concentration ; 9 transporter proteins (for glucose) move to cell membrane / AW ; 10 cells increase glucose uptake ; 11 facilitated diffusion ; 12 increase in, metabolism of glucose / respiration ; 13 (causes conversion of) glucose to glycogen or fat ; 14 inhibits glucagon ; 15 drop in blood glucose concentration detected by α cells ; 16 glucagon released (into blood) ; 17 (causes conversion of) glycogen to glucose ; 18 correct ref glycogenolysis / gluconeogenesis ;	8 max
			QWC - clear, well organised using specialist terms ; <i>At least 4 of the terms shown in bold: α cells / β cells, Islets of Langerhans, adipose, negative feedback, set point / norm, insulin, transporter proteins, facilitated diffusion, metabolism, glycogen, glucagon, glycogenolysis, gluconeogenesis,.</i>	1
	(c)	(i)	<u>hypoglycaemia</u> ;	1
		(ii)	too much insulin ; too little food ; insulin dose and food intake not <u>balanced</u> / AW ; too much exercise ; forgetting to use insulin ; lack of glucagon ;	3 max
		(iii)	glucose is main respiratory substrate ; brain can only use glucose ; may go into a coma ; may have a heart attack ;	2 max

Question			Expected Answers	Marks
	(d)	(i)	before damage from diabetes becomes irreversible / AW ; may still have some β cells left / AW ;	1 max
		(ii)	(chemotherapy) destroys dividing cells ; no increase in, B / T, lymphocytes ;	1 max
		(iii)	bone marrow ;	1
		(iv)	multipotent ; ACCEPT pluripotent DO NOT CREDIT totipotent can <u>differentiate</u> ; develop into, endocrine cells / β cells / any tissue ; own cells not rejected / AW ; less risk of introducing infection ;	3 max
			Total:	24

Question			Expected Answers	Marks
5	(a)	(i)	number of responses decreases with age / AW ; number of responses improves as test repeated / AW ; improvement is much less / AW, in 80 year olds ; <i>ora</i> 10 year olds <u>always</u> higher ; <i>ora</i> comparative figs to illustrate, both axes ;	3 max
		(ii)	the nervous system deteriorates with age ; neurones start to die (at 18) ; detail of deterioration of neurone function (e.g. myelin sheath, active transport) ; impulses transmitted faster in, the young / 10 yr olds ; <i>ora</i> ability to learn / conditioning, decreases with age / AW ; <i>ora</i> deterioration of, visual / hearing, function affecting ability to respond ;	3 max
		(iii)	it is, simple to conduct / non-invasive ; it is involuntary ; cannot be modified by environment / AW ; can indicate brain damage / dementia ;	3 max
		(iv)	sudden movement of, object / hand towards the eye / AW ; sudden sound ;	1 max

Question			Expected Answers	Marks
	(b)	(i)	<p><i>If candidate lists more than one cause mark each separately and award only the highest.</i></p> <p>cataract ; lens becomes cloudy ; protein in lens denatures ; lose elasticity ; <u>accommodation</u> poor ; cannot focus easily ;</p> <p>OR</p> <p>macular degeneration ; <i>candidates are not required to distinguish between DMD and</i> <i>WMD</i> (in wet MD) blood vessels grow into macular / AW ; prevent light reaching macular ; (in dry MD) visual pigments broken down ; <u>rhodopsin</u> / <u>iodopsin</u> ; by lysosomes ; form insoluble fragments ; cells of retina die ;</p>	4 max
		(ii)	<p>loss of, independence / confidence / AW ; lack of mental stimulation qualified ; e.g. cannot read / watch television difficulty in making social contact ; e.g. using telephone inability to drive / need to use public transport ; depression ;</p>	3 max
			Total:	17

Question			Expected Answers	Marks
6	(a)	(i)	a random / spontaneous change (in a chromosome) ; in the, gross / visible, structure of chromosomes ; and / or, the number of chromosomes ; ACCEPT <i>definition using an example</i>	2 max
		(ii)	involves a number of <u>genes</u> ;	1
		(iii)	symptoms may affect many organs / AW ; many different metabolic effects / AW ; gene therapy not possible ;	1 max
	(b)		XXY / man with 2 X chromosomes / man has extra X chromosome / non-disjunction of <u>sex chromosomes</u> ;	1
	(c)	(i)	extra X causes feminine characteristics / AW ; reduces the effect of, masculine characteristics / Y chromosome ; too much oestrogen ; not enough testosterone ;	2 max
		(ii)	testosterone injections ; use of, donated sperm / sperm banks ; gamete intra fallopian transfer / GIFT ; intracytoplasmic sperm injection / ICSI ; IVF ;	3 max
		(iii)	may pass on tendency for non-disjunction / AW ; prevents natural selection / AW ; increased costs to NHS qualified ;	2 max
Total:				12

Question			Expected Answers	Marks
7	(a)		<p><i>structure</i> circular molecule / ring, of DNA ;</p> <p><i>explanation:</i> can be cut by restriction enzymes ; (may) contain resistance genes ; easy to incorporate desired gene ; can be, taken up by bacteria / transferred from one bacterium to another ;</p> <p>can be genetically engineered ; can clone themselves ;</p>	4 max
	(b)	(i)	<p>leaves, sticky ends / blunt ends ; each restriction enzyme is specific ; to, a particular base sequence / GGATC / 5-8 base pairs ; complementary / palindromic sequences ; heat stable ;</p>	2 max
		(ii)	<p>active site of DNA ligase ; complementary to sugar and phosphate of DNA backbone / AW ; forms E-S complex ; lowers activation energy ; seals nicks / bond forms / links sugar phosphate backbone ; by condensation (reaction) ; ref to phosphodiester bond ;</p>	3 max
		(iii)	<p>placed in a solution containing, calcium <u>ions</u> / Ca^{2+} (and heated) ; DO NOT ACCEPT Ca^+</p>	1
	(c)	(i)	<p>has located locus of some genes / AW ; has identified differences in genotype of individuals with genetic disease / AW ; has identified some genes coding for proteins which may be malfunctioning / AW ; marker genes may be located to identify some mutant alleles ;</p>	2 max
		(ii)	<p>deciding who has access to the information / confidentiality ; deciding who owns the information ; discrimination against, insurance / mortgages ; genetic diagnosis may involve other members of the family ; ref to whether individual wants to know ; changing somatic cells does not prevent the damaged alleles being passed on to next generation / AW ; creates genetic underclass ;</p>	4 max
Total:				16

Grade Thresholds

Advanced GCE Human Biology (3886. 7886)
January 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2856	Raw	60	49	43	38	33	28	0
	UMS	90	72	63	54	45	36	0
2857	Raw	60	39	34	29	25	21	0
	UMS	90	72	63	54	45	36	0
2858/B	Raw	120	95	84	73	62	51	0
	UMS	120	96	84	72	60	48	0
2866	Raw	90	66	58	51	44	37	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 (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	2.5	17.3	48.1	79.0	97.5	100.0	82
7886	0.0	14.3	38.1	76.2	100.0	100.0	23

105 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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