

Human Biology

Advanced GCE A2 7886

Advanced Subsidiary GCE AS 3886

Mark Schemes for the Units

June 2008

3886/7886/MS/R/08

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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

Question	Expected Answers	Additional Guidance	Marks
1 (a) (i)	A ;	ACCEPT <u>right atrium</u>	1
1 (a) (ii)	AV / atrioventricular / tricuspid, valve ;		1
1 (b)	closed ; closed ;		2
1 (c)	arterioles ; capillaries ; venules ; veins ; <i>All correct 4 marks Any 3 in correct sequence 3 marks Any 2 in correct sequence 2 marks Arteriole or vein in correct place 1 mark</i>		4 max

Question	Expected Answers	Additional Guidance	Marks
1 (d)	<p><u>volume</u> of blood ; ejected from <u>left</u> ventricle, per, minute / unit time ;</p> <p>Q = HR x SV ; or CO = HR x SV ;</p>	<p>ACCEPT leaving left side of heart DO NOT CREDIT per, second / beat</p> <p><i>Award 1 mark for correct formula</i></p>	2 max
			[Total: 10]

Question	Expected Answers	Additional Guidance	Marks
2 (a) (i)	<p>P cholesterol ;</p> <p>Q glycolipid ;</p> <p>R <u>extrinsic</u> protein ;</p> <p>S phospholipid ;</p>		4
2 (a) (ii)	<p>molecules can move ;</p> <p>membrane consists of more than one type of molecule ;</p>	<p>ACCEPT movement of any molecule present in the membrane</p> <p>Candidates must imply different types of molecules</p> <p>DO NOT CREDIT many molecules</p>	2
2 (a) (iii)	<p>presence of C=C;</p>	<p>DO NOT CREDIT references to C=O bond</p>	1
2 (b)	<p>energy, storage / metabolism ;</p> <p>insulation ;</p> <p>ref. to essential fatty acids / omega 3 / omega 6 ;</p> <p>ref. to myelin sheath ;</p> <p>ref. to protection of organs ;</p> <p>storage of fat-soluble vitamins / named ;</p> <p>synthesis of other named molecules e.g. cholesterol ;</p> <p>(unsaturated triglycerides may) lower blood cholesterol levels ;</p> <p>ref. to HDLs ;</p>	<p>DO NOT CREDIT making energy</p> <p>DO NOT CREDIT answers that refer to ease of breakdown without reference to energy</p> <p>ACCEPT correct reference to energy source</p> <p>DO NOT CREDIT insoluble</p>	4 max
			[Total: 11]

Question	Expected Answers	Additional Guidance	Marks
3 (a)	<p><i>explanation marks are linked to the relevant condition</i></p> <p><i>condition</i></p> <p>C1 refrigerator ;</p> <p>C2 4 °C ;</p> <p>C3 buffer / constant pH ;</p> <p>C4 Ca²⁺ removed / chelating agent added ;</p> <p>C5 anticoagulant / named ;</p> <p>C6 <u>sterile</u> conditions ;</p> <p>C7 use of gas permeable bags ;</p> <p style="text-align: right;">4 max</p> <p><i>explanation – temperature</i></p> <p>E1 prevents ice crystal formation ;</p> <p>E2 prevents, cell / membrane, damage ;</p> <p>E3 prevents, protein / enzymes, <u>denaturing</u> ;</p> <p>E4 <u>slows, enzyme / metabolic/ chemical, reactions</u> ;</p> <p>E5 slows, microbial / bacterial, growth ;</p>	<p>ACCEPT 2 - 6 °C</p> <p>DO NOT CREDIT stops enzymes working</p> <p>ACCEPT stops microbial growth</p>	<p>8 max</p>

<p>E6 <i>explanation - buffer</i> prevents, protein / enzymes, <u>denaturing</u> ;</p> <p>E7 <i>explanation – Ca²⁺ removed / anticoagulant</i> prevents blood <u>clotting</u> ;</p> <p>E8 <i>explanation – anticoagulant</i> prevents blood <u>clotting</u> ;</p> <p>E9 <i>explanation – sterile conditions</i> prevents infection of blood ;</p> <p>E10 <i>explanation - gas permeable bags</i> allows gas exchange ;</p>			
	<p>QWC – clear, well organised, using specialist terms ; <i>At least 3 terms from:</i> Ca²⁺, enzyme, clotting, chelating, denature, anticoagulant, sterile, bacterial, microbial, pH, buffer, metabolic</p>		1

Question	Expected Answers	Additional Guidance	Marks														
3 (b) (i)	<i>one mark per row</i>		3														
	<table border="1"> <thead> <tr> <th rowspan="2">donor blood group</th> <th colspan="2">recipient blood group</th> </tr> <tr> <th>B</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>x</td> <td>x</td> </tr> <tr> <td>AB</td> <td>x</td> <td>x</td> </tr> <tr> <td>O</td> <td>✓</td> <td>✓</td> </tr> </tbody> </table>	donor blood group	recipient blood group		B	O	A	x	x	AB	x	x	O	✓	✓	;	
donor blood group	recipient blood group																
	B	O															
A	x	x															
AB	x	x															
O	✓	✓															
3 (b) (ii)	clumping together / AW ; of, erythrocytes / <u>red</u> blood cells ;	ACCEPT clumping alone DO NOT CREDIT clumping of inappropriate molecules/cells DO NOT CREDIT clot	2														
3 (b) (iii)	Rhesus / any correct alternative ;		1														
			[Total: 15]														

Question	Expected Answers	Additional Guidance	Marks
4 (a)	smoking ; cholesterol readings <u>above 9</u> ; (systolic) blood pressure <u>above 170</u> (mm/Hg) ;	<i>allow one mark if no data quoted for high blood pressure and high cholesterol</i>	3
4 (b)	risk factors will change over 10 year period ; different age ; ref to data based on averages can not be applied to an individual / AW ; smoking not quantified / AW ; different genetic susceptibility ; different named environmental risk factor ; 2 nd different named environmental risk factor ; ref to appropriate medication e.g. statins	Candidate must imply that the individual's age may be outside the range specified in the question. e.g. stress, low activity, high salt diet , low HDL:LDL, high <u>saturated</u> fat diet, (high) alcohol intake, overweight	3 max
4 (c)	damages, <u>endothelium</u> / <u>tunica intima</u> ; most damage occurs at branching points ; LDL's deposited ; <u>cholesterol</u> is deposited ; <u>in</u> artery wall ; (deposition is) at a higher rate ;		3 max
			[Total: 9]

Question	Expected Answers	Additional Guidance	Marks
5 (a)	plasma ; endothelial ; tissue fluid ; more ;		4
(b) (i)	(contraction) compresses veins ; forces blood towards heart ; valves prevent back flow ; prevents blood pooling / maintains, blood flow / circulation ; clots less likely to form (in circulating blood) ;	ACCEPT forces blood back up (to the heart) ACCEPT answers relating to less clotting factors present.	3 max
(b) (ii)	2 ;; <i>one mark for</i> 50 ÷ 2637 ;	ACCEPT one mark for decimalisation of answer e.g. 1.9	2 max
[Total : 9]			

Question	Expected Answers	Additional Guidance	Marks
6 (a)	open airway ; detail of method (of opening airway) ; check for obstructions ; pinch nose closed ; take a (normal) breath ; place lips around victim's mouth / use mouthpiece ; exhale steadily ; take mouth away ; repeat ;	e.g. head tilt / chin lift ACCEPT hold nose DO NOT CREDIT use of 'pump' DO NOT CREDIT blow forcefully ACCEPT breathe out / blow air out	4 max
6 (b)	hold baby to support head / AW ; place lips over mouth <u>and</u> <u>nose</u> ; take smaller breaths ; breathe out <u>gently</u> / AW ; stop when chest rises ;	ACCEPT airway opened with jaw thrust	2 max
			[Total: 6]

2857 Growth, Development and Disease

Question	Expected Answers	Additional Guidance	Marks
1 (a) (i)	anaphase ;		1
(ii)	centromeres have divided ; chromatids are attached to spindle at centromere ; (chromatids) pulled to opposite poles ; centromeres first ; as, spindle fibres / microtubules shorten ;	DO NOT CREDIT chromosomes ALLOW chromatids are separating	2 max
(b) (i)	DNA replication ; during interphase / S phase ; produces identical (sister) chromatids ; (sister) chromatids separated at anaphase ; one chromatid from each pair goes to each daughter cell ;	DO NOT CREDIT chromosomes ALLOW a suitably labelled diagram to show separated chromatids and movement to opposite poles	3 max
(ii)	CREDIT any two points from the list: growth (of new cells and tissues) ; replacement of cells ; repair of damaged tissue ; maintains, chromosome / diploid number ; maintains genetic stability ; asexual reproduction ;	If more than two roles given, mark the first two only ALLOW a described example of growth DO NOT CREDIT repair of cells DO NOT CREDIT asexual reproduction in bacteria	2 max
			[Total: 8]

Question	Expected Answers	Additional Guidance	Marks
2 (a)	mutation ; polypeptide ; base ; amino ; soluble ; low ;	Words must be given in correct order	6
(b)	genetic code is <u>degenerate</u> ; more than one codon for some amino acids ; altered codon may code for the same amino acid ; altered codon may code for a different amino acid with similar properties ; altered codon may be for an amino acid that does not have an important part to play in the functioning of haemoglobin ;	Underlined words <u>must</u> be used for the mark to be awarded ALLOW a description / example of a silent mutation	3 max
(c) (i)	ultrasound ; (hypodermic), syringe / needle ; through, abdomen / vagina, into womb ; sample of chorionic villus <u>tissue / cells</u> ; from placenta ;	Underlined words <u>must</u> be used for the mark to be awarded	3 max
(ii)	may cause miscarriage (of foetus) ; may introduce infection ;	DO NOT CREDIT 'damages foetus'	
(iii)	decision whether to abort foetus or not ; decision to have child that they know will have the disease ; religious / cultural objection to medical intervention ; might result in loss of healthy foetus ; is having the test worth the increased risk of miscarriage ;	ALLOW 'is level of increased risk of miscarriage acceptable' DO NOT CREDIT 'playing God'	2 max
			[Total: 15]

Question	Expected Answers	Additional Guidance	Marks												
3 (a)	<p><i>Description 3 max:</i></p> <p>growth rate drops across age range 0 years to 20 years ; growth rate drops rapidly, up to 3 / 4 years / initially ; growth rate falls slowly within period 3 / 4 and 11 / 12 years ; growth rate increases / growth spurt from 11/12 years; growth rate drops rapidly between 15 and 18 / 20 years ; growth levels off at 20+ ; comparative figures to support trends ;</p> <p><i>Reasons:</i></p> <p>correct reference to production of growth hormone ; growth spurt occurs at puberty ; fully developed at 20 ;</p>	<p>DO NOT CREDIT stays constant from 3 / 4 to 11 / 12 years</p> <p>2x & 2y quotes</p> <table border="1" data-bbox="1352 536 1951 783"> <thead> <tr> <th colspan="2" data-bbox="1352 536 1951 571">KEY POINTS</th> </tr> <tr> <th data-bbox="1352 571 1653 639">age / years</th> <th data-bbox="1653 571 1951 639">height / mm per year</th> </tr> </thead> <tbody> <tr> <td data-bbox="1352 639 1653 675">0.2</td> <td data-bbox="1653 639 1951 675">208</td> </tr> <tr> <td data-bbox="1352 675 1653 710">4.0</td> <td data-bbox="1653 675 1951 710">80</td> </tr> <tr> <td data-bbox="1352 710 1653 745">14.0</td> <td data-bbox="1653 710 1951 745">94</td> </tr> <tr> <td data-bbox="1352 745 1653 783">20.0</td> <td data-bbox="1653 745 1951 783">8</td> </tr> </tbody> </table> <p>ALLOW +/- 4 mm per year and +/- 0.2 years</p> <p>Reasons must be correctly linked to descriptions</p>	KEY POINTS		age / years	height / mm per year	0.2	208	4.0	80	14.0	94	20.0	8	4 max
KEY POINTS															
age / years	height / mm per year														
0.2	208														
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20.0	8														
(b)	<p>record the height at beginning and end (of the month or year) ; calculate increase in height ; add increase in heights together ; divide by the number of children or divide by number of months followed by number of children ;</p>	<p>ALLOW 'record the height every month or year'</p> <p>ALLOW weight / mass</p> <p>DO NOT CREDIT 'measurement unqualified'</p>	2 max												

(c)	<p>carbohydrates / glucose / starch ; energy ;</p> <p>lipids ; energy / essential fatty acids / cell membranes / hormones ;</p> <p>proteins / amino acids ; to make, new protein or type of protein or name of a protein ;</p> <p>calcium (ions) ; strengthen, bones / teeth ;</p> <p>iron ; (formation of) red blood cells / haemoglobin ;</p> <p>vitamin A ; vision ;</p> <p>vitamin D ; bone strength ;</p> <p>phosphorus ; to make nucleic acids / DNA / RNA / nucleotides or ADP / ATP ;</p> <p>Vitamin C ; healthy skin ;</p> <p>folic acid ; promote cell division or healthy nervous tissue ;</p> <p>iodine ; functioning of thyroid / production of thyroxine ;</p>	<p>ALLOW sugar</p> <p>ACCEPT AS NEUTRAL growth, makes new cells</p> <p>DO NOT CREDIT prevents spina bifida</p> <p>DO NOT CREDIT fibre and role of fibre ALLOW 2 max for naming nutrients without stating a role for each.</p>	<p>4 max</p>
		[Total: 10]	

Question	Expected Answers	Additional Guidance	Marks																				
4 (a)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">type of immunity</td> <td style="width: 25%;">gives immediate protection</td> <td style="width: 25%;">gives long lasting protection</td> <td style="width: 25%;"></td> </tr> <tr> <td>passive natural</td> <td colspan="2" style="text-align: center;"><i>given</i></td> <td></td> </tr> <tr> <td>active natural</td> <td style="text-align: center;">no</td> <td style="text-align: center;">yes</td> <td style="text-align: center;">;</td> </tr> <tr> <td>passive artificial</td> <td style="text-align: center;">yes</td> <td style="text-align: center;">no</td> <td style="text-align: center;">;</td> </tr> <tr> <td>active artificial</td> <td style="text-align: center;">no</td> <td style="text-align: center;">yes</td> <td style="text-align: center;">;</td> </tr> </table>	type of immunity	gives immediate protection	gives long lasting protection		passive natural	<i>given</i>			active natural	no	yes	;	passive artificial	yes	no	;	active artificial	no	yes	;	One mark for each row of correct responses	3
type of immunity	gives immediate protection	gives long lasting protection																					
passive natural	<i>given</i>																						
active natural	no	yes	;																				
passive artificial	yes	no	;																				
active artificial	no	yes	;																				
(b) (i)	plasma cell ;		1																				
(ii)	A : <u>antigen</u> binding site / variable region ; B : constant region / heavy chain ; C : <u>disulphide</u> bridge ;	ALLOW 'antigen specific site' for A ALLOW 'polypeptide' for B Underlined words <u>must</u> be used for the mark to be awarded DO NOT CREDIT 'sulphur bridge' for C	3																				
(iii)	antibody or antigen binding site, is a <u>specific shape / structure</u> ; the shape complements that of the antigen ;	Underlined words <u>must</u> be used for the mark to be awarded ALLOW a suitably labelled diagram to show complementary nature of antibody and antigen	2																				

Question	Expected Answers	Additional Guidance	Marks
4 (c)	<ol style="list-style-type: none"> 1. pathogen / named pathogen / antigen, introduced into body ; 2. dead / attenuated / weakened form of pathogen ; 3. detected as foreign ; 4. causes a (primary) immune response ; 5. clonal selection, of B cells or T killer cells with receptors complementary to antigen ; 6. B cells or T killer cells divide by mitosis or undergo clonal expansion ; 7. (clonal expansion) promoted by, T helper cells / cytokines ; 8. production of memory cells ; 9. remain in the circulation ; 10. if same antigen / pathogen enters the body again / booster given ; 11. causes a faster (secondary) response ; 12. memory cells differentiate immediately into, plasma cells / T killer cells ; 13. more, antibodies / T killer cells produced ; 14. destroys disease organism before it has time to reproduce and cause symptoms ; <p>QWC – legible text with accurate spelling, punctuation and grammar;</p>	<p>DO NOT CREDIT injection of disease for point 1</p> <p>ALLOW ecf for second use of disease instead of antigen / pathogen</p> <p>ALLOW less harmful form of pathogen for point 2</p> <p>ALLOW stays in blood or body for point 9</p> <p>ALLOW destroys disease organism before it makes the person ill for point 14</p> <p>DO NOT CREDIT if more than three spelling errors</p>	<p style="text-align: center;">7 max</p> <p style="text-align: center;">1</p>
[Total: 17]			

Question	Expected Answers	Additional Guidance	Marks
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5	(a)	production of <u>genetically</u> identical cells or tissues or individuals ;	Underlined words <u>must</u> be used for the mark to be awarded	1
	(b)	(i)	(stem cells are) unspecialised or undifferentiated ; pluripotent or have the potential to, develop / differentiate into many types of cell or tissue ; (stem cells) keep dividing ; produce large numbers of cells ;	Words shown in brackets are not required in the answer 2 max
	(ii)	(culture) <u>medium</u> ; sterile ; (medium must contain) growth factors ; (medium must contain) nutrients ; suitable temperature / pH ;	Underlined words <u>must</u> be used for the mark to be awarded ALLOW chemicals added to stimulate growth for growth factors ALLOW temperature within range 20-40°C, pH 6-8	2 max
	(iii)	cells becomes adapted, for their function / to carry oxygen ; genes switch on or off ; causing haemoglobin to be made ; loss of nucleus ; take on, special shape / biconcave disc ;	ALLOW genes activated for genes switch on	3 max
	(c)	CREDIT any two points from the list: more tissues / organs available ; no need for donors ; reduced waiting time ; will not cause a strong immune response or be rejected by recipient ; recipients won't need to take immunorepressive drugs for life ; less likely to transmit infectious disease ;	If more than two benefits given, mark the first two only	2 max
				[Total: 10]

2858/01 Case Studies

Question	Expected Answers	Additional Guidance	Marks
1 (a) (i)	no double bonds / has single bonds ; between C atoms ; (in) fatty <u>acids</u> ; AVP ; e.g. 3 fatty acids and 1 glycerol / triglyceride e.g. (saturated fats are) solid at room temperature	ALLOW 'saturated fats have single bonds', or 'each carbon has 2 hydrogens' for marking point 1 DO NOT ALLOW 'hydrogen bonds' CREDIT marking points 1 and 2 on diagrams DO NOT CREDIT references to 'healthier' for AVP	3 max
1 (b) (i)	linoleic / linolenic ; Contains more than one double bond ;	fatty acid must have correct spelling	2
1 (b) (ii)	(eat) less animal fat / named animal fat / ORA ;	ACCEPT 'eat more vegetable fat or oil / named vegetable' ACCEPT reduced amount of named animal product e.g. dairy product or meat OR increased amount of fruit / vegetable ACCEPT 'use corn oil rather than olive oil'.	1

(b) (iii)	34.2 ;; If incorrect answer given, credit one mark for the following steps: 11% of 11510 = 1266 ; N//37 calculated ;	1 MARK ONLY for 34 or if they give more than one decimal place but answer is correct. If final answer is incorrect, give 1 mark if incorrect percentage (N) has been converted correctly to g (divided by 37)	2
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Question	Expected Answers	Additional Guidance	Marks
1 (c)	1. (high saturated fat) raises LDL levels ; 2. ref. LDL / HDL ratio ; 3. (LDLs) deposit cholesterol / AW ; 4. (cholesterol or fat) in, artery wall ; 5. ref. coronary artery ; 6. <u>atherosclerosis</u> / <u>atheromatous plaques</u> ; 7. <u>lumen</u> size, reduced / narrowed ; 8. (less) oxygen , to cardiac / heart muscle ; 9. ref. angina ; 10. ref. coronary thrombosis / described ; 11. heart muscle, dies / myocardial infarction ; 12. AVP ; e.g. ref. endothelium 13. AVP ; e.g. ref. foam cells or macrophages	2. CREDIT 'raises LDL:HDL'. DO NOT CREDIT 'raises HDL :LDL' 3. CREDIT 'fats build up' idea. DO NOT CREDIT fats deposited in TISSUES 4. DO NOT CREDIT 'in artery' 5. DO NOT CREDIT 'artery' alone 6. CREDIT phonetic spelling 7. DO NOT CREDIT 'artery narrowed' 8. DO NOT CREDIT 'less oxygen to heart' or '....to muscle'. CREDIT oxygenated blood. 10. CREDIT description of a clot or clotting if coronary artery is clearly implied.	7 max
1 (d)	foetal alcohol syndrome / FAS ; liver damage ; AVP ; e.g. obesity, pancreas damage, brain damage, diabetes	CREDIT phonetic spelling CREDIT damage to any relevant organ DO NOT CREDIT lung damage CREDIT psychological or sociological consequences	1 max

1 (e)	<p>1. (blood pressure) has systolic and diastolic (pressures) ; 2. ref. systolic is, first figure/ 5.5 ; 3. ref. diastolic is, second figure/3.0 ;</p>	<p>1. is a general point. For 2. and 3., the correct figure needs to be matched to the correct pressure.</p>	2 max
1 (f)	<p>1. 3 groups to compare ; 2. DASH alone, LOW SALT alone AND DASH + LOW SALT ; 3. ref control group / no intervention / AW ; 4. AVP ; e.g. ref numbers in each group , variables controlled, measuring blood pressure</p>	<p>1. CREDIT idea of at least 3 groups 2. Must describe the three treatments 3. CREDIT 'on a normal diet' 4. CREDIT a named variable being controlled such as time, use people who are hypertensive.</p>	3 max

Question	Expected Answers	Additional Guidance	Marks
1 (g)	1. (high) salt in blood (plasma) ; 2. lowers , <u>water potential</u> ; A more negative 3. water moves, into blood / out of tissues ; 4. increase in blood volume ;	1. DO NOT CREDIT 'high salt in body' 2. CREDIT if candidate refers to water moving from high to low water potential or down a water potential gradient. 3. DO NOT CREDIT idea of water moving into or out of blood cells	2 max
			[Total: 23]

Question	Expected Answers	Additional Guidance	Marks
2 (a) (i)	1. dividing cells / mitosis (happening) ; 2. spindle formation halted / (mitosis) stopped in metaphase ; 3. cells, treated with salt solution / osmotic swelling ; 4. chromosomes, stained/dyed ; 5. (chromosomes) viewed down microscope ; 6. (chromosomes) photographed / scanned ; 7. (chromosomes) cut and pasted/ computer manipulated ; 8. chromosomes paired up / (matched in pairs) ; 9. AVP ; e.g. ref. colchicines, phytohaemagglutinin	4. DO NOT CREDIT 'cells are stained' 5. DO NOT CREDIT 'cells viewed down microscope' For 6 and 7, CREDIT idea of digital scanning and manipulation, for example, with photoshop 8. DO NOT CREDIT 'chromatids' paired up	4 max
(a) (ii)	(normal) male ; (1 X and) 1 Y chromosome ;	CREDIT 'boy' instead of male CREDIT wrong karyotype but correct reason for that karyotype for Down's and Klinefelters for one mark DO NOT CREDIT for Turners as this information is given.	2

(b) (i)	1. (gametes must be) <u>haploid</u> cells ; 2. (gametes have) 1 copy of each chromosome / 23 chromosomes/ n ; 3. (following) fertilisation ; 4. diploid number / 46 / 2n, restored / maintained ; AVP ; e.g. ref. (genetic) variation	CREDIT named gametes 2. CREDIT idea that meiosis halves the chromosome number 4. CREDIT reverse argument	2 max
(b) (ii)	1. (mitosis gives) genetically identical, (daughter) cells ; 2. (mitosis gives cells with) same number of chromosomes ; 3. (same number) as parent cell ; 4. (same number) as each other ;	CREDIT 'identical DNA' for marking point 1 CREDIT reference to specific number (45) for marking point 2 CREDIT reference to original cell for marking point 3	3 max
(c)	1. amniocentesis / chorionic villus sampling ; 2. detail of named procedure ; 3. AVP ; a further detail of same procedure	CREDIT CVS for chorionic villus sampling Marking point 2, the detail must match the procedure named BUT Marking point 3 can be awarded for MORE correct description of a procedure where the name has been omitted.	2 max
(d) (i)	below the line, similar shape ;	Look for evidence of lower line levelling off	1

Question	Expected Answers	Additional Guidance	Marks
2 (d) (ii)	1. calculate growth ; 2. over a period of time ; 3. plot growth <u>rate</u> against time ; 4. growth rate Y axis, time X axis ;	1. CREDIT change in height or weight for markscheme. 2. CREDIT a given time interval such as 1 year. Both marking points 1 and 2 could be given for the correct formula or rate derived from first graph. 3 and 4. CREDIT 'age' for time.	3 max
2 (e)	Mammography / mammogram ; detail ; chest X-ray (lung cancer) ; detail ; thermography ; detail ; AVP ; a further detail / explanation of one method AVP ; a further detail / explanation of another method	DO NOT CREDIT 'X-rays' alone as a named method CREDIT up to 3 named techniques to include PET scans, MRI scans, CT scans, ultrasound. CREDIT up to 2 marks for description / explanation of a technique.	5 max
[Total: 22]			

2866 Energy, Control and Reproduction

Question	Expected Answers	Marks
1 (a) (i)	(aerobic) respiration ; DNA replication ; proteins synthesised ; organelles / named, synthesised ; cell growth occurs ; energy stores increase ; AVP ; e.g. correct ref. to chromosomes condense <u>at end</u> of interphase / AW	3 max
(ii)	chromosome number maintained ; basis of growth (in multicellular organisms) ; basis of cell replacement ; AVP ; e.g. can perform same role as <u>parent cells</u>	2 max
(iii)	(presence of) <u>LH</u> / <u>FSH</u> ; development of follicle ;	1 max

(b)

<i>mitosis</i>	<i>meiosis</i>
one (division per) cycle / AW	two (divisions per) cycle / AW ;
chromosomes do not separate	(homologous) chromosomes separate (meiosis I) ;
two cells produced	four cells produced ;
diploid cells produced / chromosome number maintained	haploid cells produced / chromosome number reduced (halved) ;
no independent assortment	independent assortment
no aligning of homologous pairs / no bivalents	homologous pairs line up / bivalents
no, crossing over / chiasmata	crossing over / chiasmata ;
occurs, in many different body cells / throughout body	only occurs, in cells producing gametes / in reproductive organs ;
for growth / repair	for reproduction / making gametes ;
AVP e.g. division of centromeres	AVP e.g. no division of centromeres (meiosis I). ;

allow one mark for a correct difference appearing in unconnected boxes

4 max

Question	Expected Answers	Marks
(c)	X-rays are a form of radiation ; X-rays may damage (DNA of) foetus ; DNA damage more likely during, replication / mitosis / AW ; many cells in (developing) foetus will be in mitosis ; affecting development leading to abnormalities /AW ; may lead to cancer / AW ; AVP ; e.g. so they can provide extra protection for the foetus during x-ray	2 max

[Total: 12]

Question	Expected Answers	Marks
2 (a) (i)	sigmoid / S-shaped ; little increase at lower pp O ₂ ; <u>then</u> rapid increase ; levelling off ; <i>credit reverse sequence for MP 2, 3 and 4</i> use of figs both axes ;	 3 max
(ii)	3.4 ;	1
(iii)	S-shaped curve ; to right of / below original curve, <u>and</u> starts at same place ;	2
(iv)	Bohr effect / shift ; <u>more</u> aerobic respiration / AW ; <u>more</u> carbon dioxide (released) ; formation of carbonic acid ; carbonic acid dissociates / haemoglobinic acid formed / HHb, formed ; Hb releases more oxygen ; AVP ; e.g. ref to carbonic anhydrase	R anaerobic 3 max
(b)	myoglobin can store oxygen (in muscles) ; (muscles) demand for oxygen exceeds supply (from oxyhaemoglobin) / AW ; oxygen concentration falls ; (oxy)myoglobin now releases its oxygen ; allows aerobic respiration to continue for longer / ora anaerobic respiration ; A increases lactate threshold / VO ₂ max increases more ATP produced for, <u>work / muscular contraction</u> ; AVP ; e.g. myoglobin can reoxygenate from (oxy)haemoglobin / AW	 3 max
(c)	fewer erythrocytes ; low concentration of haemoglobin ; (leads to) inadequate supply of oxygen / AW ; AVP ; e.g. haemoglobin concentration is a limiting factor / AW	A RBC R lack / no RBC 2 max

[Total: 14]

Question	Expected Answers	Marks
3 (a) (i)	<p>low(er) concentration of <u>oxygen</u> / AW ; so concentration of oxygen in blood falls ; kidneys respond ; by secreting erythropoietin / EPO ; erythrocyte / red blood cell production increases / AW ; total blood volume also increases ; concentration of Hb also increases ; more oxygen delivered to tissues ; VO₂ max increases / aerobic respiration continues for longer ; AVP ; e.g. ref. to returning to lower altitude qualified</p>	<p>A increased lactate threshold 5 max</p>
(ii)	<p>sprinting not an endurance event ; sprinters use (mainly) <u>anaerobic</u> respiration ; <i>ora</i> applies anaerobic respiration produces ATP without oxygen /AW ; so extra oxygen not beneficial / AW ; AVP ; e.g. relies upon stores of ATP / CP</p>	<p>R makes/produces energy 3 max</p>
(b)	<p>takes time to produce more red blood cells / adapt / AW ; ability to work hard reduced / AW ; altitude sickness (may result) ; AVP ; e.g. symptom described</p>	<p>R acclimatise, unqualified 2 max</p>
(c)	<p>eating <u>high</u> level of, carbohydrate / named example ; to increase glycogen stores (in, muscles / liver) ; for a <u>short period</u> before a, race / event / competition ; AVP ; e.g. use of figs (6-10g per kg body mass)</p>	<p>2 max</p>
(d) (i)	<p>increased respiration in muscles releases heat ; core body temperature must be kept stable / correct ref to homeostasis ; sweat released to cool body down ; <u>water</u> lost (via sweating) ; <u>more risk</u> of dehydration ; AVP ; e.g. muscles work less efficiently when dehydrated</p>	<p>3 max</p>
(ii)	<p>isotonic drinks, contain / replace, solutes / electrolytes / ions / salt ; <u>which are lost in</u> sweat ; isotonic drinks have, same / similar, water potential as body fluids / AW ; glucose in drinks may be used for respiration ; enables athlete to continue to exercise for longer ;</p>	<p>R neutral 3 max</p>

[Total: 18]

Question	Expected Answers	Marks
4 (a) (i)	2.25 ;; <i>allow range 2.19 – 2.31</i> <i>If answer incorrect allow one mark for</i> 35 – 37 ÷ 16000 OR answer incorrect by factor of ten e.g. 22.5 OR Answer not rounded to 3 sig. fig. / 2 d.p.	2 max
(ii)	vacuole ; membrane bound organelles ; mitochondria ; ER ; Golgi apparatus ; vesicles ; nucleus ; grana ; thylakoids ; lamellae ; starch grain ;	A tonoplast 2 max
(b) (i)	diffusion ; R facilitated diffusion from region of higher concentration to region of lower concentration / AW ; down concentration gradient ; through phospholipid bilayer ; R semi-permeable / selectively permeable membrane AVP ; e.g. using kinetic energy (of oxygen molecules) A does not require ATP / energy	3 max
(ii)	to provide large(r) surface area ; R ref. to surface area to volume ratio more space for chlorophyll / AW ; for greater light absorption ; allow faster (overall) rate of reaction ; AVP ; e.g. for reactions to occur / AW more space for more, electron carriers / enzymes	2 max

(c)

statement	producer e.g. maize	primary consumer e.g. beef cattle	secondary consumer e.g. human
can use energy from the sun	✓	X	X
consumes most energy	X	✓	X
uses energy to synthesise essential chemicals e.g. vitamins	✓	✓	✓
wastes the least energy	✓	X	X

;

;

;

3 max

mark in rows

[Total: 12]

Question	Expected Answers	Marks
5 (a) (i)	allow action potentials from one neurone to be passed to another ; one way transmission of impulses / AW ; interconnection of more than one nerve pathway (convergence or divergence) ; amplification / increased sensitivity, of response ; allows a range of responses to action potentials / AW ; allows coordination of responses from variety of sources ; AVP ; e.g. adaptation and fatigue qualified / filters out weak background stimuli	3 max
(ii)	mitochondria, produce ATP / release energy ; for (re)synthesis of, neurotransmitter / ACh ; ref to transport ; R diffusion AVP ;	2 max
(b) (i)	similar to structure of a neurotransmitter ; enkephalin /endorphin ; fits / attaches to / blocks receptor on postsynaptic membrane ; blocks impulses from pain receptors / AW ; AVP ;	3 max
(ii)	stimulates pleasure pathway / makes you feel happy / relaxed ; inhibits GABA secreting neurones ; (GABA) normally inhibits dopamine / AW ; increase in dopamine produces, positive response / dependency ;	2 max
(c) 1	(arrival of action potential) depolarises presynaptic membrane ;	
2	sodium channels open ;	
3	sodium ions move into, synaptic knob / presynaptic membrane ;	
4	calcium channels open ;	R incorrect ion notation e.g. Ca ⁺
5	calcium ions move <u>in</u> (to synaptic knob) ;	
6	vesicles containing, ACh / acetylcholine / neurotransmitter ;	
7	move to / fuse with presynaptic membrane ;	
8	release contents into synaptic cleft ;	
9	diffuse across cleft ;	
10	ACh / neurotransmitter binds to protein receptors ;	
11	on postsynaptic membrane ;	
12	changes shape of protein ;	
13	causes sodium ion channels to open ;	
14	influx of sodium ions into cytoplasm of postsynaptic membrane / AW ;	
15	AVP ; e.g. ref to recycling of neurotransmitter / acetylcholinesterase	8 max

QWC – clear well organised using specialist terms ;

At least four of the terms marked in bold

depolarises

neurotransmitter

calcium ion

vesicles

fuse

acetylcholine

synaptic cleft

diffuse

protein receptors

sodium ion

A other named example of neurotransmitter

1

[Total: 19]

Question	Expected Answers	Marks
6 (a) (i)	ovary ; uterine wall / uterus / myometrium ; cervix ;	3
(ii)	intersect of 'x' must appear within shaded areas of either oviduct ; see diagram on next page ;	1
(b) (i)	(human) chorionic gonadotrophin / (h)CG ;	1
(ii)	1 dipstick dipped into urine / AW ; 2 (antibodies) present on end of dipstick / AW ; 3 which are not attached / are mobile ; 4 (these antibodies are) specific for hCG ; 5 (these antibodies have) a marker / dye / gold molecule ; 6 hCG in urine binds to antibodies ; 7 idea of complementary shapes ; 8 antibodies carried / move up the stick ; 9 <u>another antibody which binds to hCG-antibody-, gold / marker, complexes ;</u> 10 <u>immobilised antibody in test region of stick / AW ;</u> 11 <u>hCG-antibody-,gold / marker, complexes held in position ;</u> 12 gold / marker molecule, accumulates ; 13 colour / line, develops ; 14 second, line / colour, to show test is working / AW ; 15 AVP ; e.g. further detail 16 AVP ; e.g. further detail	6 max
	another antibody which binds to (h)CG-antibody-,gold / marker, complexes ; present in test result region of stick / AW ;	
	QWC – spelling, punctuation and grammar, legible text <i>Candidates should have no more than three different spelling errors.</i> <i>Sentences should be accurately punctuated according to spoken English and text should be legible. Must be at least ½ a page.</i>	1
(c) (i)	two or more, embryos / foetuses, in uterus / AW ;	1
(ii)	premature / early baby ; low birth weight ; anaemia in mother ; diabetes in mother ; pre-eclampsia, in mother ; (increased risk of) miscarriage ; vanishing twin syndrome ; AVP ; e.g. underdeveloped foetus AVP ; e.g. increased risk of c-sections	2 max

[Total: 15]

2867 Genetics, Homeostasis and Ageing

Question	Expected Answers	Marks
1 (a) (i)	<p><i>Any two from the following</i></p> <p>intracellular fluid ; tissue / extracellular fluid ; lymph ; cerebral spinal fluid ; synovial fluid ; sweat ; mucus ; semen ; saliva ; glomerular filtrate ; aqueous / vitreous, humour ; urine ; gastric juices / AW ;</p> <p><i>R Plasma</i></p>	2 max
(ii)	<p>(good) <u>solvent</u> ; (so) allows chemical reactions to take place / transports, substances / solutes / named e.g ;</p> <p>neutral pH ; enzymes not, affected / denatured / AW ;</p> <p>reactant ; involved in hydrolysis reactions / named e.g ; <i>R photosynthesis</i></p> <p>high specific heat capacity ; (so) temperature is (relatively) stable / AW ;</p> <p>high latent heat of evaporation ; (so) causes cooling / AW ;</p> <p>creates hydrostatic pressure ; named e.g. filtration in glomerulus ;</p> <p><i>2 max for list of properties without advantage described</i></p>	3 max
(iii)	<p>erythrocytes / red blood cells ; platelets ; leucocytes / white blood cells ; large protein molecules / over relative molecular mass of 68 000 / named ; fat (droplets) ;</p>	2 max
(b) (i)	<p>X anywhere on the collecting duct ; <i>If X appears alongside the diagram a label line MUST be used</i></p>	1
(ii)	<p>A Bowman's / renal, capsule ; B <u>proximal</u> convoluted tubule / lumen of tubule ; <i>A PCT</i></p>	2

continued

Question Expected Answers
1 cont'd

Marks

(c)	hypothalamus	contains the osmoreceptors	
	posterior pituitary gland	<u>secrete</u> ADH ; R produces ADH	
	osmoreceptors	sensitive to / detects, changes in the <u>water potential</u> (of the blood) ; <u>secrete</u> / <u>release</u> , ADH ; transport ADH (to posterior pituitary) along their axons ;	1 max
	loop of Henlé	creates high concentration of, sodium ions / Na ⁺ / chloride ions / Cl ⁻ in tissue fluid / medulla / AW ; allows reabsorption of water from collecting ducts / production of concentrated urine / AW ;	1 max
			3 max

- (d) (concentration) affects water potential ;
 water potential affects osmosis ;
 cells may, shrink / burst ;
 affects rate of enzyme-controlled reactions ;
 affects diffusion of solutes / AW ;
 AVP ; e.g. affects exchange between, blood and tissue fluid / tissue fluid and cells

4 max

[Total: 17]

Question	Expected Answers	Marks
2 (a) (i)	5 (%) ;; <i>If answer incorrect allow 1 max for</i> $\frac{4496}{84555} \times 100$ OR answer given to incorrect number of decimal places	2 max
(ii)	age (at start of investigation) ; family history / genetic predisposition / AW ; <i>A ethnic origin</i> physical activity ; (initial) BMI / other measurement method ; other foods in diet / named ; smoking ; AVP ; e.g. distribution of body fat (“apple-shaped” or “pear-shaped” figures) <i>R use of control group</i>	3 max
(b) (i)	potatoes contain, starch / polysaccharide ; digested to glucose ; glucose increases insulin concentration ; desensitises cells to insulin / AW ;	<i>A complex carbohydrates</i> 3 max
(ii)	<i>accept ora throughout</i> insulin dependent ; <i>A insulin has to be injected</i> pancreas / β cells , incapable of secreting insulin ; early onset ; (may be) an autoimmune condition ; not caused by, diet / obesity / high BMI / AW ;	3 max
(c)	hypothalamus ; negative feedback ; as body fat increases leptin production increases ; stimulates hypothalamus to decrease appetite ; as body fat decreases leptin production decreases ; appetite increases ;	1 4 max
		[Total: 16]

Question	Expected Answers	Marks
3 (a)	DXA / DEXA / dual emission X-ray absorptiometry / X-ray ; (usually of) lower spine / hip / wrist / ankle / heel ; the denser the bone the more X-rays are absorbed / AW / ora ; bone mineral / calcium content measured ; computer converts (X-ray) image into a density score ; results compared against (international) standard ; low (density) score indicates osteoporosis / ora ;	3 max
(b) (i)	increases from 20 to, 35 / 36 ; then decreases (slowly until) 50 ; decreases more quickly after, 50 / menopause / AW ; decreases more slowly from 64 / remains constant at 64 to 75 ; drops below fracture threshold at 79 ; <i>A Range from 77-80</i>	3 max
(ii)	bones fracture easily at or below this threshold / AW ;	1
(iii)	greater dependence on family or carers / AW ; more dependence on NHS ; (possible) financial implications ; need for mobility aids / adaptation of home environment ; cannot maintain (usual) lifestyle / AW ;	3 max
(c)	less oestrogen / no oestrogen ; parathormone activity increases / AW ; (parathormone) increases osteoclast activity ; osteoclasts decrease, bone calcium / bone density ;	2 max

continued

Question 3 Expected Answers
cont'd

Marks

(d) *development*

- D1 follicles** less sensitive to **FSH** ;
D2 (follicles) do not develop ;
D3 oestrogen level drops ;
D4 FSH / LH, concentration increases ;
D5 menstruation / ovulation, stops ; *R periods*
D6 (as) **oestrogen** does not thicken, **endometrium** / lining ;
D7 (concentration of) LH /FSH, peaks 1-3 years after last menstruation ;
D8 increases risk of, **cardiovascular** disease / **CHD** ;

5 max

treatment

- T1** symptom of withdrawal of oestrogen e.g. hot flushes, dry skin / membranes ;
R osteoporosis
T2 HRT ;
T3 regular doses of oestrogen (usually) with **progestin** ; **A progesterone**
T4 detail of treatment e.g. cyclic / continuous / taken all the time / patches /
T5 implants ;
T6 rationale for treatment e.g. oestrogen only for women having had hysterectomy ;
T7 alternative treatments
phyto-oestrogens / **isoflavones** (in soya) / **coumestans** (in e.g. in alfalfa) / **lignans** (in, cereal / vegetables / fruit) ;
antioxidants / named (vitamins A / C / E / beta carotene) ;

5 max 7 max

QWC - clear, well organised using specialist terms ;

1

At least 4 of the terms shown in bold:

follicles, FSH, LH, oestrogen, endometrium, cardiovascular disease, CHD, HRT, progestin, progesterone, implants, phyto-oestrogens, isoflavones, coumestans, lignans, antioxidants.

[Total: 20]

Question	Expected Answers	Marks
4 (a)	(sum of) chemical reactions that occur / amount of energy released ; amount of, respiration that occurs / respiratory substrates used e.g. glucose ; per unit time ;	2 max
(b)	less ATP produced / respiration slows down ; less energy for, growth / movement / nerve conduction / other example ; less heat released (from respiration) ; (so) body temperature not regulated / AW ;	3 max
(c)	transport in blood ensures wide distribution / increases solubility (for transport) ; targets specific cells / AW ; could be broken down in transit ; no effect on water potential (of blood) ; prevents removal from body ;	2 max
(d)	not self regulating / AW ; establishes correct dose / AW ;	1 max
(e) (i)	thyroid (gland) / follicle cells ;	1
(ii)	antibody complements the shape of the receptor / AW ; locks onto the receptor site / AW ; R active site A binding site <u>competes</u> with TSH for site / may block the receptor site ; enzyme reactions are not triggered / AW ;	2 max
(iii)	HLA means human leucocyte antigen ; (antigen) found in all cells except erythrocytes ; there are, 4 / 6, gene loci ; all linked / inherited together (to form a haplotype) / on chromosome 6 ; collectively known as MHC / determines tissue type ; (haplotype has) many alleles for each locus / AW ;	3 max
		[Total: 14]

Question	Expected Answers	Marks
5 (a)	the (mutant) <u>allele</u> is recessive ; masked by dominant allele / AW ; only expressed in homozygote / AW / ora ;	2 max
(b) (i)	<u>goblet</u> (cell) ;	1
(ii)	(altered protein channels) prevent chloride ions leaving the cell / AW ; <u>water potential</u> of the cell drops ; less water moves out of cell / less water enters mucus ; by <u>osmosis</u> ; down <u>water potential</u> gradient ;	3 max
(iii)	(mucus) blocks (reproductive) ducts ; lower sperm count / fewer sperm released / AW ; sperm find it harder to swim / AW ; sperm less likely to reach oocyte ; A ovum sperm run out of, ATP / energy / AW ; (thicker mucus) may be more, toxic / alkaline / acidic ;	3 max

(c)

father without cystic fibrosis		mother without cystic fibrosis
Ff		Ff ;
child without cystic fibrosis		child with cystic fibrosis
FF ;	Ff ;	ff ;

4

continued

Question Expected Answers
5 cont'd

Marks

(d) (i)

change associated with ageing	potentially harmful effects on lung function	
air spaces enlarge	reduced SA for gaseous exchange / AW ; less oxygen uptake ; less CO ₂ excreted ;	2 max
elasticity of the alveoli decreases	Forced Expiratory Volume (FEV ₁) decreases ; expiration not efficient ; TV reduced / peak flow reduced ; debris / dust / bacteria, accumulate in the lungs / increased risk of infection ;	2 max
immune system becomes less active.	greater chance of, lung infections / named e.g. flu ; dormant / opportunistic, infections may develop ; AVP ; e.g. increased risk of lung cancer	2 max

6 max

- (ii) don't smoke / avoid passive smoking ;
(take more) exercise ;
eat a diet rich in e.g. antioxidants, vitamins ;
avoid (possible) sources of infection ;
relevant vaccination ;

3 max

[Total: 22]

Question	Expected Answers	Marks
6 (a) (i)	<p>1 high blood pressure / hypertension ; 2 150 is the systolic (pressure) ; 3 when the <u>left</u> ventricle contracts ; 4 100 is the diastolic (pressure) ; 5 pressure in arteries when ventricles are relaxed / residual pressure in the system / AW ;</p> <p><i>if no figures are quoted for marking points 2 <u>and</u> 4 accept 1 mark</i></p> <p>6 measured in mm Hg ;</p>	3 max
(ii)	<p>high blood pressure is a risk factor for, CHD / stroke / myocardial infarction ; normal blood pressure is 120 over 80 (mm Hg) ; A up to 130 over 85 (mm Hg) (although the blood pressure is high) tissues are not well oxygenated ;</p>	2 max
(b)	<p><i>comment on data</i></p> <p>T1 the number of transplants rose from 1991 to 1995 ; T2 then fell (until 2000) ; T3 the number of transplants in 1996 and 1997 remained the same / AW ; T4 figs to illustrate both axes ; T5 the waiting list increased from, 1991 to 2000 / from 4000 to 5 600 ; T6 donated organs, remain relatively constant up to 1997 / decrease (slightly) from 1996-2000 ;</p> <p style="text-align: right;">5 max</p> <p><i>reasons for shortage</i></p> <p>R1 tissue type must match ; R2 detail of, HLA / haplotypes ; R3 must be correct size ; R4 opt in rather than opt out system (in UK) / AW ; R5 difficult to approach relatives at time of grief / surgeons may not ask / relatives may say no / AW ; R6 religious / ethical / cultural, objection / AW ; R7 some people excluded from donating e.g. HIV sufferers / AW ; R8 increased demand, better health care ; R living longer on its own R9 AVP ; e.g. more people surviving (traffic) accidents</p> <p style="text-align: right;">5 max 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

continued

Question 6 cont'd
(c)

Mark

source of organ	advantage	disadvantage
animal	no problems of supply ; no-one has to die ; (can be) genetically engineered (to match) ; 1 max	ethical objections ; disease transmission ; incompatibility ; 1 max
non-related living donor	organs can be bought ; wider supply of organs ; no death of donor ; 1 max	black market / exploitation (of donors) ; problems with matching ; disease transmission ; 1 max
<u>identical</u> twin ;	genetically identical	family pressure to donate

5

[Total: 18]

Question	Expected Answers	Marks
7 (a)	(the cell surface membrane of) the erythrocytes ; A red blood cells carry the Rhesus <u>antigen</u> ; lack / do not produce antibodies for the Rhesus antigen ; will initiate antibody production (in Rhesus negative individuals) / AW ;	3 max
(b) (i)	(allele) not on sex chromosomes / on somatic chromosomes ; (allele) always expressed (in phenotype) / AW ; if, heterozygous / homozygous ;	2 max
(ii)	0.5 / 50% / $\frac{1}{2}$ / 1 in 2 / 1 : 1 ;	1
(c)	secondary response quicker ; (because) memory cells are present ; (memory cells) stimulated by (Rhesus) antigen ; A blood to divide by <u>mitosis</u> ; producing, a clone / plasma cells / clonal expansion ; more antibodies produced (more quickly) ; antibodies not formed until after the first pregnancy ;	4 max
(d)	second child may (also) be blood group, A / AB ; mother has A antibodies in her plasma already / AW ; which destroy the foetal, erythrocytes / red blood cells (entering mother's bloodstream) ; before they can initiate her immune response ; (therefore) no Rhesus positive antibodies produced by the mother ; mother may have, RhoGAM / anti D injections ; masks Rhesus antigen ;	3 max

[Total: 13]
PAPER TOTAL 120

Grade Thresholds

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

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2856	Raw	60	43	37	31	26	21	0
	UMS	90	72	63	54	45	36	0
2857	Raw	60	45	39	33	27	22	0
	UMS	90	72	63	54	45	36	0
2858/A	Raw	120	97	84	71	59	47	0
	UMS	120	96	84	72	60	48	0
2858/B	Raw	120	95	82	69	57	45	0
	UMS	120	96	84	72	60	48	0
2866	Raw	90	69	60	52	44	36	0
	UMS	90	72	63	54	45	36	0
2867	Raw	120	80	71	62	54	46	0
	UMS	120	96	84	72	60	48	0
2868	Raw	90	74	66	58	50	42	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (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	3.0	14.0	32.5	57.4	78.7	100	1641
7886	6.4	23.0	47.7	75.6	94.5	100	984

2625 candidates aggregated this series

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