

Human Biology

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

Mark Schemes on the Units

January 2007

3886/7886/MS/R/07J

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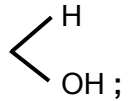
Advanced Subsidiary GCE Human Biology (3886)

MARK SCHEME ON THE UNITS

Unit	Content	Page
2856	Blood, Circulation and Gaseous Exchange	1
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**Mark Scheme 2856
January 2007**

Question	Expected Answers	Marks														
1 (a)	<table border="1"> <thead> <tr> <th>statement</th> <th>true or false</th> </tr> </thead> <tbody> <tr> <td>enzymes are globular proteins</td> <td>true ;</td> </tr> <tr> <td>they do not alter the rate of metabolic reactions</td> <td>false ;</td> </tr> <tr> <td>the reaction takes place in the active site</td> <td>true ;</td> </tr> <tr> <td>the secondary structure of an enzyme molecule refers to the order of amino acids in the polypeptide chain</td> <td>false ;</td> </tr> <tr> <td>one enzyme will hydrolyse a range of substrates</td> <td>false ;</td> </tr> <tr> <td>human enzymes will begin to denature above 40^o C</td> <td>true ;</td> </tr> </tbody> </table>	statement	true or false	enzymes are globular proteins	true ;	they do not alter the rate of metabolic reactions	false ;	the reaction takes place in the active site	true ;	the secondary structure of an enzyme molecule refers to the order of amino acids in the polypeptide chain	false ;	one enzyme will hydrolyse a range of substrates	false ;	human enzymes will begin to denature above 40 ^o C	true ;	6
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one enzyme will hydrolyse a range of substrates	false ;															
human enzymes will begin to denature above 40 ^o C	true ;															
(b)	<p>horizontal line between reactants energy level and uncatalysed activation energy level ; ;</p> <p>OR</p> <p>peaks between reactants energy level and uncatalysed activation energy level ;</p> <p>starts on the existing line ;</p>	2 max														
(c) (i)	rate would increase / AW ;	1														
(ii)	<p>more (frequent) collisions ;</p> <p>correct reference to active site ;</p> <p>more enzyme-substrate complexes / AW ;</p> <p>correct reference to, turnover number / V_{max}, / AW ;</p>	3 max														
(d)	<p>streptokinase / named clotbusting drug ;</p> <p>A named anticoagulant eg heparin / warfarin</p>	1														
Total		13														

2	(a)	(i)		1
		(ii)	condensation ;	1
		(iii)	disaccharide ; A dimer/maltose	1
		(iv)	can be broken down in stages / AW ; <u>ATP</u> can be formed (from glucose) ; AVP ; e.g. soluble, therefore can be transported easily can be stored as glycogen / polysaccharide	1 max
	(b)		A first ; D C in correct order ; E last ;	3
	(c)	(i)	Z ;	1
		(ii)	affects, osmosis / water potential (of blood) ; description of the direction of water movement ; AVP ; e.g. named symptom of high / low glucose concentration eg damage to retina / coma / effect on blood pressure	2 max
Total				10

3

A from labels on the diagram

credit correct responses wherever they appear on the page

gaseous exchange

- 1 oxygen diffuses, into blood capillaries / out of alveolus ;
- 2 CO₂ diffuses, into the alveolus / out of the capillaries ;
- 3 down concentration gradient / AW ;
- 4 detail e.g. random movement of molecules ;

features

- 5 alveoli have a large surface area ;
- 6 presence of surfactant ;
- 7 (alveolar wall) squamous epithelium ;
- 8 alveolar, walls / cells, thin / flat ; **A drawing**
- 9 high surface area to volume ratio ;
- 10 presence of elastin / elastic tissue, /AW ;
- 11 many capillaries around each alveolus ;
- 12 (alveoli) in close contact with blood capillaries ;
- 13 short, diffusion distance / AW ; *max 5*
- 14 AVP ;
- 15 AVP ; e.g. connected to terminal bronchioles
correct ref. to one cell thick
total surface area 70 m²
only five membranes for gases to pass through **7 max**

QWC – legible text with accurate spelling, punctuation and grammar ;**1**

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

Total**8**

4	(a)	bronchitis ; cancer ; COPD ; AVP ; e.g. asthma	2 max
	(b)	<ol style="list-style-type: none"> 1 <u>neutrophils</u> collect in the lungs ; 2 secrete an enzyme ; 3 (neutrophil) elastase / protease ; (<i>neutrophil elastase</i> = 2 & 3) 4 breaks down elastin / elastic fibres ; 5 (walls of) alveoli break down ; 6 loss of elasticity ; 7 reduction in surface area ; 8 cilia damaged ; R <i>cilia die</i> 9 goblet cell, activity / number, increased ; 10 more mucus present ; 11 bronchioles / airways <u>inflamed</u> ; 12 scar / fibrous tissue builds up ; 13 AVP ; 	5 max
	(c)	(i) 45 ;	1
		(ii) females smoking 10 to 19 cigarettes not included ; former smokers who have given up not included ;	2
		(iii) correct reference to age of subjects in sample ; cigarette advertising targeted males more ; AVP ; AVP ; e.g. occupational stress levels greater for men (eg frontline soldiers) historic effect older women less likely to have smoked men more likely to admit to having smoked greater peer pressure for men (used to be) more socially acceptable for men to smoke	2 max
Total			12

5	(a)	(i) correct part labelled ;	1
		(ii) supplies heart / cardiac, <u>muscle / tissue</u> ; with oxygen / glucose ; for respiration / AW ;	2
		(iii) smoking ; diet high in <u>saturated</u> fat ; high cholesterol / LDL's ; R <i>dietary cholesterol</i> higher ratio of LDLs to HDLs / AW ; lack of exercise ; too much salt (in diet) ; too much alcohol (in diet) ; AVP ; AVP ; e.g. genetic predisposition hypertension age obesity being male	max 3
	(b)	(i) endothelium / (tunica) intima ;	1
		(ii) stretched in context ; recoil to, smooth / maintain, blood flow ;	2
		(iii) less scar tissue will form ; less likely to block the <u>coronary</u> artery ; less loss of elasticity / AW ; less need for repeat surgery ; AVP ; e.g. causes less inflammation	2 max
Total			11

6	(a)	(i)	myocardial infarction / heart attack / cardiac arrest / AW ;	1
		(ii)	place two/three fingers ; check at, neck / wrist / forehead ; carotid / radial / temporal (artery) ; count number of pulses in a, short period / named period ; correct multiplication to give beats per minute ; AVP ; e.g. detail of precise location for finger placement detail of stethoscope repeating the procedure again	3 max
	(b)		heart block ; Purkyne tissue, damaged / do not conduct properly ; AV node not functioning properly ;	2 max
	Total			6
	PAPER TOTAL		60	

**Mark Scheme 2857
January 2007**

Question	Expected Answers	Marks									
1 (a)	not specialised / undifferentiated ; able to keep dividing / AW ; large nuclear / cytoplasmic ratio ; pluripotent ; can develop into specialised cells / AW ;	2 max									
(b)	develop into <u>heart / cardiac muscle cells</u> ; to replace <u>damaged cells</u> ; stem cells differentiate ; divide / multiply ; by mitosis ; AVP ; e.g. heart muscle cells don't normally divide	2									
(c)	may give false hope / AW ; may transmit infection ; Ignores rights of donor ; fate of embryo / blastocyst ; religious / cultural reasons ; may cause an immune response in patient / AW ; AVP ; e.g. may lead to cloning	2									
(d) (i)	<table border="1"> <tbody> <tr> <td>B</td> <td>metaphase ;</td> <td>chromosomes lined up in centre of cell / on equatorial plate ; R <i>pairs of chromosomes</i> chromosomes made up of two chromatids ; chromatids held together at centromere ; chromosomes attached to spindle fibre by centromere ; <i>1 max</i></td> </tr> <tr> <td>C</td> <td>anaphase ;</td> <td>centromere / chromosomes splits / divides ; <u>chromatids</u> separated / pulled to opposite ends of cell / AW ; <i>1 max</i></td> </tr> <tr> <td>D</td> <td>telophase ;</td> <td><u>chromatids</u> unwind / become new chromosomes / AW ; chromatids / new chromosomes in two groups (at opposite ends of cell) / AW ; <i>1 max</i></td> </tr> </tbody> </table>	B	metaphase ;	chromosomes lined up in centre of cell / on equatorial plate ; R <i>pairs of chromosomes</i> chromosomes made up of two chromatids ; chromatids held together at centromere ; chromosomes attached to spindle fibre by centromere ; <i>1 max</i>	C	anaphase ;	centromere / chromosomes splits / divides ; <u>chromatids</u> separated / pulled to opposite ends of cell / AW ; <i>1 max</i>	D	telophase ;	<u>chromatids</u> unwind / become new chromosomes / AW ; chromatids / new chromosomes in two groups (at opposite ends of cell) / AW ; <i>1 max</i>	6
B	metaphase ;	chromosomes lined up in centre of cell / on equatorial plate ; R <i>pairs of chromosomes</i> chromosomes made up of two chromatids ; chromatids held together at centromere ; chromosomes attached to spindle fibre by centromere ; <i>1 max</i>									
C	anaphase ;	centromere / chromosomes splits / divides ; <u>chromatids</u> separated / pulled to opposite ends of cell / AW ; <i>1 max</i>									
D	telophase ;	<u>chromatids</u> unwind / become new chromosomes / AW ; chromatids / new chromosomes in two groups (at opposite ends of cell) / AW ; <i>1 max</i>									
(ii)	produces cells with the same number of chromosomes ; <u>genetically</u> identical / same DNA ; has the correct information to develop into exactly the same type of cell ; so can carry out the same role ; AVP ;	3 max									
Total		15									

- 2 (a) (i) lots of antibiotics are used in hospital ;
 natural selection ;
 resistant strains more likely to develop in hospitals ;
 (patients ill) may have a weakened immune system ;
 proximity to patients with MRSA ;
 inadequate cleaning qualified ;
 not washing hands qualified ;
 AVP ; e.g. visitors bring it in 2 max
- (ii) screen new patients for MRSA ;
 isolate patients with MRSA ;
 barrier nursing / explained ;
 use of narrow spectrum antibiotics ;
 make sure course of antibiotics completed ;
 wash hands qualified ;
 adequate cleaning qualified ;
 AVP ; 3 max
- (b) **A** (loop of) DNA ; **R** *nucleus*
B cell wall ;
C cytoplasm ; 3
- (c) *One named antibiotic with activity that prevents growth of bacteria*
antibiotic
 penicillin / tetracycline / streptomycin / methicillin / erythromycin /
 other named ;
activity preventing growth
 prevents formation of cell walls / prevents protein synthesis or
 translation / prevents enzymes working / prevents DNA
 replication or transcription ;
 AVP ;
 AVP ; 2 max
- Total** 10

3	(a)	change in <u>number / structure</u> of chromosome / 45 chromosomes ;	1
	(b)	(i) Turner's syndrome ;	1
		(ii) Only one X chromosome ;	2
		(iii) amniocentesis / described ; chorionic villus sampling / CVS ;	1 max
		(iv) cells cultured ; stimulated to undergo mitosis ; colchicine added ; stops formation of spindle fibres ; cell division stopped at metaphase ; cells put in water / weak salt solution ; cells swell and chromosomes separated ; cells / chromosomes stained ; use of microscope ; photographed / viewed on computer screen ; chromosomes arranged in matching/homologous pairs / AW ; AVP ; e.g. name of chemicals that stimulate mitosis	3 max
	(c)	<i>one issue linked to EACH example</i>	
		<i>example 1</i> having a child that you know will suffer ; having to decide to abort a foetus ; may restrict quality of life / qualified ;	
		<i>example 2</i> telling someone they will develop a disease for which there is no cure ; not knowing whether the gene has been passed on to children ; deciding whether to have children or not ; discrimination qualified ; AVP ;	2 max
Total			9

- 4 (a) (i) to allow direct comparisons to be made ;
takes account of different sizes of populations ; 1
- (ii) $\frac{2372 \times 100}{8810} = 27 \%$
correct answer only ; ;
correct method wrong answer ;
not whole number 1 max 2
- (iii) *Ora applies throughout*
- 1 more cases in Africa / comparative figures ;
 - 2 more overcrowding ;
 - 3 poor standard of housing;
 - 4 malnutrition ;
 - 5 more AIDs / HIV sufferers ;
 - 6 weakened immune system / AW ;
 - 7 poor country ;
 - 8 not enough money for treatment ;
 - 9 not diagnosed ;
 - 10 drug resistant form ;
 - 11 antibiotics very expensive / can't afford ;
 - 12 not enough health workers / doctors / nurses / medical care ;
 - 13 to make sure course of antibiotics completed ;
 - 14 vaccine not available ;
 - 15 AVP ;
 - 16 AVP ; 5 max
- (b) if there is no reaction to the skin test / skin doesn't redden and
become raised ;
child does not have immunity ;
so BCG vaccination offered ;
If positive / red need a chest X-ray ;
AVP ; 2 max

- 4 (c)
- 1 vaccine is made from live, attenuated bacteria ;
 - 2 acts as an antigen / recognised as foreign ;
 - 3 B lymphocyte / cell ;
 - 4 clonal selection;
 - 5 which best matches antigen in vaccine ;
 - 6 selected to divide by mitosis / clonal expansion;
 - 7 role of T helper cells in stimulating clonal expansion
 - 8 make lots of identical B lymphocytes ;
 - 9 differentiate into, plasma cells / memory cells ;
 - 10 memory cells stay in circulation ;
 - 11 recognise TB bacterium / pathogen should it enter the body ;
 - 12 differentiate straight away / AW into plasma cells ;
 - 13 make antibodies;
 - 14 which help to destroy bacteria before they can reproduce and
make person ill ;
 - 15 AVP ;
 - 16 AVP ; e.g. antigen presentation / further detail correct **6 max**
reference to primary / secondary response

QWC clear, well organized, using specialists terms

1
[Total: 17]

5	(a)	(i)	ultrasound ; mammography ; biopsy ; MRI ; PET ;	2 max
		(ii)	cancer cells less likely to have invaded other parts of the body / AW ; AVP ;	1 max
	(b)		mutation ; proto-oncogene ; mitosis ; tumour ; benign ; malignant ;	6
Total				9

**Mark Scheme 2858/01
January 2007**

Question	Expected Answers	Marks
1 (a) (i)	(time in which) <u>ventricles</u> are contracting ;	1
(ii)	(filling time) decreases ;	1
(b)	(from) SAN ; (spreads) across atria ; no direct conduction to ventricles / AW ; picked up by AVN ; (impulse conducted) through Purkyne tissue / Bundle of His ; (spreads) across ventricles ; AVP ; ; e.g. pos ⁿ of nodes / ref myogenic / contraction from base	4 max
(c)	press on sternum ; ref frequency /100 per minute, 15 times ; A 30 ref rescue breaths ; rescue breath detail ; alternate / AW, compression and rescue breaths ; A 30:2 AVP ; ; e.g. exact location of hands / 4 cm depression / different for child	4 max
(d)	(angioplasty) balloon (inflated) / AW ; opens up artery lumen / described ; (angiogram) detecting, blocked (coronary) artery ; A narrowed AVP ; e.g. ref to X-ray / use of dye	2 max
(e)	(streptokinase is) antigen ; (first dose) led to clonal selection / clonal expansion ; ref memory T-cells / B-cells ; ref more rapid second response ; ref more antibodies in second response ; AVP ; ; e.g. antibody production linked to B lymphocytes,	3 max
(f) (i)	high density lipoprotein, low density lipoprotein ; <i>both for one mark</i>	1
(ii)	ref importance of ratio HDL:LDL ; (HDL) remove cholesterol (from tissues) ; (LDL) increase deposition / AW ; AVP ; e.g. HDL less triglyceride / cholesterol / ora ref to targets set	2 max
(iii)	glycerol / correctly drawn and labeled ; 3, fatty acids / correctly drawn and labeled ; ester bond / drawn and labeled ; AVP ; e.g. ref to saturated / unsaturated fatty acids differ from one triglyceride to next double bonds in unsaturated (fatty acids)	3 max
(g)	heart <u>muscle</u> /cells, deprived of oxygen ; (cells) cannot respire <u>aerobically</u> ; anaerobic respiration/lactate, stimulates production of LDH ; AVP ;	2 max
Total		23

- 2 (a) folic acid ; to reduce risk of spina bifida ;
AVP ; ; e.g. rhesus antibody test , (to prevent) haemolytic disease **2 max**
- (b) *Similarities*
 S1 polynucleotides/AW ;
 S2 (nucleotide contains) deoxyribose ;
 S3 phosphate group ;
 S4 (nitrogenous) base
 S5 ref purines/pyrimidines ;
 S6 adenine, guanine, cytosine, thymine ; **A letters**
 S7 sugar-phosphate backbone/phosphodiester bond ;
 S8 AVP ;
 S9 AVP ; eg both transcribed / AW **5 max**
- Differences – refer to human DNA*
 D1 complementary, base pairing ;
 D2 ref hydrogen bonds ;
 D3 A and T two / C and G three ;
 D4 double stranded ;
 D5 antiparallel strands/AW ;
 D6 double helix ;
 D7 AVP ;
 D8 AVP ; e.g. in chromosomes
 A with T and C with G **5 max 8 max**
- (c) blood (diluted) with reagent ;
 detail ; e.g. Drabkins reagent / potassium cyanide / ferricyanide /
 1:200 dilution
 haemoglobinocyanide formed / AW ;
 ref standard / blank ;
 ref colorimeter / AW
 ref spectrometer ;
 AVP ; e.g. yellow green filter / 540 nm
Allow 1 mark for non-standard method. **3 max**
- (d) (i) (viral DNA)codes for more viruses / AW ;
 stem cell does not differentiate ;
 protein synthesis disrupted / AW ;
 haemoglobin not produced ; **2max**
- (ii) Sick Hb does not carry enough oxygen / AW ;
 Hb concentration already low ;
 AVP ; **1 max**
- (e) differentiate ;
 pluripotent ;
 nucleus ;
 mitosis ; **4**

2 (f)	too late in pregnancy / AW ; (virus causes) an infectious disease / not a genetic disease ; (virus causes) no changes to chromosomes ; (amniocentesis) increases risk ; AVP ; ; e.g. detail of procedure to explain risk	2 max
Total		22

**Mark Scheme 2866
January 2007**

1	(a)	(i)	<p>A spermatogonium / germinal, epithelial cell / epithelium ;</p> <p>B (maturing) spermatozoon / sperm ;</p>	2
		(ii)	produce testosterone ;	1
	(b)		<p>S, Q, U, R, P, T ; ; ;</p> <p><i>S + T correct location ;</i></p> <p><i>Q + U correct location ;</i></p> <p><i>R + P correct sequence ;</i></p>	3 max
	(c)		<p>prevent movement of water in / out of (sperm) cells ;</p> <p>by osmosis ;</p> <p>cells may dehydrate / burst ;</p> <p>correct ref to <u>water potential</u> gradients ;</p> <p>maintain suitable environment for (sperm) cells ;</p> <p>AVP ; e.g. isotonic / ref to correct internal environment within sperm for reactions etc</p>	3 max
	(d)	(i)	<p><i>gene</i></p> <p>length / sequence / AW of, DNA / nucleotides ;</p> <p>coding for polypeptide ; A <i>protein</i></p> <p>single / sense strand ;</p> <p>unit of inheritance ;</p> <p><i>allele</i></p> <p>different form of a gene ;</p> <p>correct named eg ;</p> <p>AVP ;</p>	4 max
		(ii)	<p><u>genetic</u> variation (in gametes / sperm) ;</p> <p>idea of conferring survival advantage of sperm / offspring ;</p> <p>offspring resulting from fertilisation will be genetically varied / AW ;</p> <p>AVP ;</p>	2 max
		(iii)	<p>random alignment / orientation / AW, of bivalents /</p> <p>homologous pairs ;</p> <p>any allele of pair can be inherited with any of another pair / AW ;</p> <p>on a different homologous pair ;</p> <p>fertilisation random process / explained ;</p> <p>no sperm / no ova are genetically identical ;</p>	3 max
Total				18

2	(a)	<p>volume of carbon dioxide given out ; divided by volume of oxygen taken in (over the same time period) ; ratio of gas exchange ;</p> <p><i>correct equation = 2 marks (1 mark for top and 1 mark for bottom)</i></p>	2 max
	(b)	<p>(i) gas / oxygen / carbon dioxide, probe / analyser ;</p> <p>(ii) obtain mean / average ; improve reliability (of data) ; R accuracy ignore outliers / anomalous results ; AVP ;</p> <p>(iii) concentrations of oxygen and carbon dioxide in (same volume) of atmospheric / inspired /AW air ; ref. to time period ;</p>	<p>1</p> <p>2 max</p> <p>1 max</p>
	(c)	<p>(i) mixture / AW, of substrates being respired ; protein qualified eg starvation ; use of figs / idea of only a theoretical value ;</p> <p>(ii) RQ value rises / AW ; above 1.0 / to ∞ ;</p> <p>anaerobic respiration does not use oxygen or produce carbon dioxide ; cannot be measured using RQ ; ref to residual aerobic respiration ;</p> <p>AVP ; e.g. only glycolysis used</p>	<p>2 max</p> <p>3 max</p>
	(d)	<p>(i) higher number of H atoms in fat / ora ; most energy obtained from electrons in H atoms ; via electron transfer chain ; so more ATP produced ; ref. to complete respiration of fat molecule / ora ; AVP ;</p> <p>(ii) broken down / digested / hydrolysed into amino acids ; breakage of peptide bonds ; correct ref to link reaction / pyruvate ; correct ref to keto acids / Krebs cycle ; AVP ; detail e.g. of deamination</p>	<p>2 max</p> <p>3 max</p>
Total			16

3	(a)	<p><i>Therapeutic use</i></p> <p>1 (THC) helps to prevent fluid build up behind eye ;</p> <p>2 treatment for glaucoma ;</p> <p>3 pain relief ;</p> <p>4 reduce nausea / vomiting (from cancer therapies) ;</p> <p>5 ref to use in MS ;</p> <p>6 to reduce muscle cramps / relax muscles ;</p> <p>7 increase appetite / prevent weight loss, in AIDS patients ;</p> <p>8 ref to problems of separating active medical ingredients from mood altering ones ;</p> <p>9 problem of obtaining supply legally in some countries ;</p> <p><i>Recreational use</i></p> <p>10 produces feelings of happiness / euphoria / AW ;</p> <p>11 relieves anxiety / causes relaxation / heightens sensations ;</p> <p>12 (mild) hallucinations ;</p> <p>13 reduce motivation / slow down thought / reduce co-ordination / damage STM ;</p> <p>14 (long term use) may cause lung cancer ;</p> <p>15 suppresses immune system ;</p> <p>16 tolerance may develop ;</p> <p>17 no physical dependency / mild withdrawal symptoms / psychological dependency rare ;</p> <p>18 AVP ;</p> <p>19 AVP ; e.g. Nabilone, contains THC, possibility of lung damage</p>	max 8
		<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
	(b)	<p>increase in availability ;</p> <p>increase in recreational use ;</p> <p>perception that drug is harmless / AW ;</p> <p>named side effect / many side effects ;</p> <p>potential of exposure to lower age range ;</p> <p>AVP ; e.g. may lead to use of harder drugs</p>	3 max
Total			12

4	(a)	(i)	higher light intensity / AW ; warmer so enzymes work faster / AW ; correct ref to day length ; AVP ;	2 max
		(ii)	converts light / solar energy ; into, potential energy / chemical energy / organic compounds / named ;	2
	(b)	(i)	(135 ÷ 2700) x 100 ; = 5% ; ; <i>correct answer = 2</i> <i>wrong answer but correct method = max 1</i>	2 max
		(ii)	some lost in <u>respiration</u> ; egestion / faeces ; excretion / named example ; some indigestible / unpalatable / eg ; only energy for growth / tissue, passed on ; humans only select best parts / AW ; AVP ; e.g. named example of reaction using ATP	3 max
	(c)		energy lost at each (trophic) level ; 10% efficient / ora ; due to excretion / respiration / movement / named example ; very little of the energy in plants transferred to humans when eating meat ; possibly more efficient as fewer (trophic) levels involved ; more pressure on arable land to produce food / AW ; grazing land not efficient w.r.t. energy transfer / AW ; humans cannot digest cellulose ; therefore diet of plants alone not necessarily more efficient ; AVP ;	3 max
Total				12

5	(a)	(i)	central nervous system / CNS ; voluntary / somatic nervous system ;	2
		(ii)	autonomic nervous system ;	1
	(b)	(i)	lens develops early / during first 3 months of pregnancy / after 3 months lens complete ; damage more likely during development / ora / AW ; dividing cells more susceptible to damage ;	2 max
		(ii)	visual acuity reduced / AW ; less light passing thorough lens ; less light falling onto retina / light sensitive cells ; AVP ; e.g. lens less elastic	2 max
	(c)	1	resting potential maintained (across membrane of rod cell) ;	
		2	negative charge on inside compared to outside / electrochemical gradient ;	
		3	synaptic, bulb / knob ;	
		4	secretes steady stream / AW, of neurotransmitter ;	
		5	glutamate ;	
		6	inhibitory transmitter / AW ;	
		7	prevents, action potentials / depolarisation, in bipolar cell ;	
		8	light changes shape of, rhodopsin molecule / visual pigment ;	
		9	cis-retinal to trans-retinal ;	
		10	interacts with proteins at cell membrane ;	
		11	causes Na ⁺ channels to close ;	
		12	inside of cell becomes more negative ;	
		13	hyperpolarised ;	
		14	stops secretion of neurotransmitter / glutamate ;	
		15	depolarisation ;	
		16	of bipolar cell ;	
		17	AVP ; e.g. -70mV (+/- 10 mV), transducer	7 max
			QWC – clear well organised using specialist terms ;	1
Total				14

6	(a)	(i)	<p>X cell (surface) membrane ; Y nucleus / nucleoplasm / chromatin ;</p>	2
		(ii)	<p>2 cm / 20mm 20 000µm in 2 cm / 20mm ; magnification = 20 000 ;</p> <p><i>correct answer only ; ; ecf ; wrong measurement, correct method max 1</i></p>	2 max
	(b)	(i)	<p>cell recognition / example ; barrier between internal environment of cell and external environment / AW ; receptor sites / named example ; passage of water by osmosis ; site of chemical reactions / named ; controls transport of substances in and out of cells ; AVP ;</p>	3 max
		(ii)	<p>unreactive / described ; deposited / forms, as cholesterol ; form LDL's / leads to increased blood cholesterol ; maximum amount of hydrogen atoms ; no double bonds ; ref to atheroma / atherosclerosis ; plaque on blood vessel <u>wall</u> ; leads to, CHD / symptom described ;</p>	3 max
	(c)	(i)	<p>by up to 50 times ; nodes of Ranvier ; gaps where myelin sheath doesn't cover axon / AW ; 1-3 mm ; myelin sheath insulates (axon) / sodium and potassium ions cannot flow through myelin sheath / ora ; action potential jumps from node / gap to next ; salutatory conduction ; local circuits set up ; AVP ; e.g. metabolically economical as fewer ions pumped</p>	5 max
		(ii)	<p>nerve impulse 'short circuits' / AW ; no (electrical) insulation ; ions leak / AW ; paralysis / slurred speech / other named symptom ; poor coordination / AW ;</p>	2 max
Total				17

**Mark Scheme 2867
January 2007**

Question	Expected Answers	Marks
1 (a)	A either the letter or the full definition	

<i>allele</i>	B	/ an alternative form of a gene ;
<i>locus</i>	D	/ the position of a gene on a chromosome ;
<i>genotype</i>	A	/ the alleles of a gene or genes possessed by an organism ;
<i>phenotype</i>	E	/ the visible or measurable characteristics of an organism ;
<i>dihybrid</i>	C	/ the inheritance of two genes / at two gene loci ;

mark for each correct answer

5 max

- (b) (i) sickle shaped / AW, rbc ;
 some normal rbc / not all cells affected ;
 poor / reduced oxygen transport ;
 breathlessness ;
 anaemia ;
 tendency to blocked capillaries ; **R** *blood vessels*
 AVP ; eg lethargic, dizzy, tired, prone to collapse **3 max**
- (ii) $Hb^A Hb^S$ / or any alternative indicating heterozygous / heterozygous ;
R *sex linked $I^S I^S$, Ss or any inference that alleles are expressed on rbc membrane*
- codominant / partial codominance ;
 not expressed at high oxygen concentration ;
- both types of red blood cells shown ;
 therefore both alleles expressed ; **R** *gene* **3 max**

- (c) *only credit the mark for 'frequency' if it is appropriate to the reason given*

two from :

may increase frequency of allele ;
resistant, to malaria / where malaria is endemic ;

OR

may increase frequency of the allele ;
better medical care / described ;

OR

decrease frequency of allele ;
sickle cell crisis may block capillaries to heart muscle / lungs ;

OR

decrease frequency of allele ;
IVF may allow detection of mutation / embryo selection / genetic screening may result in aborting foetus ;

OR

decrease frequency of allele ;
amniocentesis / chorionic villus sampling, may abort foetus ;

OR

increase / decrease in frequency of allele ;
due to immigration / emigration qualified ;

OR

AVP ;
AVP ; e.g. decrease if die of sickle cell disease / malaria before having children
ref to death must refer to effect of disease

4 max

- (d)

<i>environmental factor</i>	<i>effect on blood film</i>
iron deficiency ;	less Hb / fewer / larger erythrocytes / red blood cells ;
folate / folic acid deficiency ;	less Hb / fewer / larger red blood cells ;
vitamin B12 deficiency ;	less Hb / fewer / larger red blood cells ; immature red blood cells ;
environmental cause of leukaemia ;	too many leucocytes / white blood cells ;
AVP ; eg high altitude	AVP ; eg increase the number of red blood cells

2 max

Total

17

- 2 (a) for ultrafiltration ;
- high pressure is needed in the glomerulus ;
AVP ; 1 max 2 max
- (b) (i) $\frac{780 \times 100}{26 \times 1000}$ or $\frac{780}{260}$
- 3 (per 100 g) ; ;
correct method but wrong figures = max 1
correct answer only = 2 marks ; ; 2
- (ii) blood flow would decrease / divert, from the kidney ;
blood flow would increase to muscle ;
- more oxygen / glucose to the muscles ;
increase removal of waste product / named ;
for ATP production / increased energy ;
- AVP ; eg urine production would reduce / cease, ref to diameter
of arteries, vasoconstriction, delays anaerobic
respiration / ora 3 max
- (c) *do not credit refs to water concentration gradients*
- 1 glomerular filtrate ;
 - 2 contains all materials in blood with molecular mass less than
65 000 – 69 000 (**A range**) / AW ;
 - 3 substances with small molecular mass / glucose/ amino acids
/ ions absorbed in proximal (convoluted) tubule ;
 - 4 65% / most, of the water, reabsorbed ;
 - 5 correct ref to microvilli (on luminal / edge cells) ;
 - 6 blood capillaries / AW, from efferent vessel lie close by ;
 - 7 low in salts / ions / glucose / soluble substances / solutes ;
 - 8 movement down diffusion gradient / described by clear
statement on gradient ;
 - 9 sodium ions actively transported out ;
 - 10 transporter proteins / carrier proteins / protein channel ;
 - 11 specific ;
 - 12 co-transport / facilitated diffusion ;
 - 13 glucose and sodium ions ;
 - 14 (movement of ions / glucose / solutes) sets up water potential
gradient ;
 - 15 water also moves out down gradient ;
 - 16 by osmosis ;
 - 17 correct ref to vasa recta ;
 - 18 ref to ADH / osmoregulation ;
 - 19 some urea also diffuses out of the filtrate ;
 - 20 AVP ; e.g. detail on active transport, intrinsic proteins,
pinocytosis 8 max
- QWC - clear, well organised using specialist terms ;** 1
- Total** 16

- 3 (a) (i) the number of cases of a particular disability ;
per 1 000 / given number (of the population of that age group) / at a
given time ; **2 max**
- (ii) *'affected' must be qualified*
- 1 arthritis / osteoporosis ;
2 detail ; eg rough bone ends, loss cartilage, decrease in bone
density
3 loss of brain cells / neurones ;
4 in cerebellum, causes problems of coordination / balance /
fine movement ; **R dexterity**
5 loss / death of neurones, in cerebral cortex ;
6 causes decline in cognitive /mental skills ;
7 damage to sensory cells / AW, in cochlea ;
8 causes difficulty in hearing high pitched sound ;
9 clouding / AW, of lens / leakage of pigments / blood in retina ;
symptom must match condition
10 cataract / macular degeneration ;
11 (either) may be caused by diabetes ;
12 damage to cardiovascular system / named part ;
13 relevant decline in any named function ;
14 AVP ; eg loss of any named function / brain damage due
to accident,
ref' to Alzheimer's disease **5 max**
- (b) (i) *dominant*
only one parent needs to have the allele ;
allele is always expressed / affects phenotype ;
even if recessive allele also present / in heterozygote ;
disease may be more common / may show in every generation ; ora
2 max
- recessive*
allele only expressed if homozygous / no dominant allele present /
AW / ora ;
both parents must be, heterozygous / carriers / have a, recessive
allele / disease ;
- AVP ; e.g. ratio **3 max**
- (ii) mutation ;
unstable part of DNA / chromosome ;
occurs in gamete formation / AW ;
not inherited ;
AVP ; eg qualification of mutation (eg any named type, named
mutagen),
from much earlier generation **2 max**
- (iii) gene is lethal before reaching reproductive age ;
idea of no longer fertile when at emotional reproductive age / AW ;
AVP ; eg screened out in IVF, may not wish to have children,
fertility decreases with developmental age / AW **1 max**

- (c) cells are programmed for a limited number of divisions before stop /
AW ;
ref to DNA progressively / AW, misread / mutates / telomeres
degrade ; **R** *ref to oncogene*
therefore cells stop dividing sooner / at earlier age / AW ;
undergo senescence ;
use of figs, both axes ;
AVP ; eg not like cancer where division never stops / not
oncogenes
- 2 max**
- Total** **15**

- 4 (a)
- 1 accurate ref to hippocampus ;
 - 2 reduction in acetylcholine secretion ;
 - 3 due to deficiency in choline acetyl transferase ;
 - 4 decrease cytochrome oxidase ;
 - 5 fibrous / protein / neurofibrillar, tangles / AW ;
 - 6 microtubules / tau (protein) ;
 - 7 in nerve cell bodies / in cytosol ;
 - 8 β amyloid protein ;
 - 9 form plaques ;
 - 10 between nerve cells ;
 - 11 increased level of β amyloid 42 / described as 42 amino acids
/ abnormal number of amino acids ;
 - 12 plaques in, blood vessels / meninges ;
 - 13 decrease in brain mass ; **A smaller**
 - 14 neurones die / lost ;
 - 15 dendrites atrophy / shorter / fewer branches ;
 - 16 fewer synapses ;
 - 17 AVP ; e.g. loss of brain mass 10% in 80 year old,
dissociation limbic system,
loss of function specific to another named area,
 - 18 AVP ; e.g. evidence of head injury, deficiency of folate,
enlarged ventricles,
ref to chromosome 21
- 7 max**
- QWC - legible text with accurate spelling, punctuation and grammar ;**
- 1**
- (b) does not show on (CAT / CT / MRI) scans ;
can only see brain shrinkage / increase in size ventricles, with these
/ plaques / tangles do not show ;
could be any type of brain damage / dementia / AW ;
observe behaviour / description of behaviour ;
examination of brain tissue only after death ;
- 2 max**
- (c) (i) more synaptic connections made / AW ;
increased glucose indicates, that neurones respiring more / increased
respiration ; **R NGF prevented the neurones from dying**
ATP / energy released for action potential / synaptic transmission /
AW ;
glucose is the only respiratory substrate in the brain ;
- 2 max**
- (ii) small sample ;
no control ;
other variables not controlled / named example e.g. genetics, age,
gender ;
no repetitions ;
could not be certain that the patients had Alzheimer's disease while
alive / AW ;
- 2 max**

- (iii) unpredictable / unexpected effects of gene therapy /
 gene expression ;
 long term effect not known / side effects unpredictable ;
 NGF carefully regulated in normal brain / may upset balance of
 chemicals in brain ;
 damage may be caused during surgery to insert cells ;
 uncontrolled growth may cause cancer / AW ;
 contamination may occur ;
 AVP ; eg risks of anaesthesia,
 risk / named, of procedures on brain,
 raises expectation,
 ethical objection to experimenting on humans
R ref to immune response **3 max**
- (iv) to repair damage to neurones in brain trauma / spinal cord damage /
 other named disease eg Parkinson's disease ;
 AVP ; **1 max**
- Total** **18**

- 5 (a) there are fewer red blood cells per (unit) volume, (therefore less oxygen to kidney cells) / AW ; 1

(b) (i)

	structure	function A ecf
<i>effector</i>	bone marrow ;	erythropoiesis/ produces, red blood cells / erythrocytes ;
<i>receptor</i>	kidney ;	detects oxygen concentration in blood / produces erythropoietin ;

4

(ii) **A a generic definition**

a reduction in oxygen to the cells / change in the parameter, is the stimulus ;

which corrects the concentration / change ;

it keeps oxygen concentration constant / at set point / norm ;

oscillates / AW, between narrow limits ;

3 max

- (c) (i) (more rbc's / Hb) to carry oxygen for (aerobic) respiration ;
more ATP for muscle contraction ;
AVP ; e.g. accurate ref to lactate threshold / AW 1 max

(ii) EPO is genetically engineered ;
gene for (human) EPO, inserted into plasmid ;
bacterium produces RhEPO ;
AVP ; e.g. detail on the technique 2 max

(iii) (an increase in red cells) increases the viscosity of the blood AW ;
clots / cells / bubbles, may block capillaries ;
may have a heart attack / stroke ;
may be banned from sport ;
AVP ; e.g. may get infection from injection,
may depress EPO production by the kidney 2 max

- (d) (i) *mark all explanations in the correct context*
- smoking reducing the oxygen level ;
 due to carbon monoxide binding to haemoglobin ;
- correct effect of altitude ;
 lung disease / named reducing oxygen level ;
- blood doping / using rbc's accumulated at altitude ;
 detail ;
- anaemia ;
 larger / immature / less Hb ;
- injecting (genetically engineered) erythropoietin ;
- ethnicity / genetics qualified ;
- AVP ; ; **3 max**
- (ii) *degrees of freedom*
 18 ;
- probability*
 0.05 / less than 0.05 / $0.01 < p < 0.05$ / between 0.05 and 0.01 ; **2**
- (iii) the results for A and B did not differ by chance / ora ; **A ecf**
 significant ;
 at the 5% probability level / less than 5 chances in 100 by chance ;
 null hypothesis rejected ;
 low confidence level / AW ;
 AVP ; eg ref to closeness to 0.5 questions the validity / AW **2 max**
- Total** **20**

- 6 (a) (i) metabolic rate slows ;
 movement may be restricted / AW ;
 diet may not be adequate ;
 less respiratory substrate / not enough food to release energy in
 respiration ;
 switch off heat to save money / can't afford adequate heating ;
 AVP ; eg nicotine may constrict capillaries,
 lack of adequate clothing, circulatory problems **2 max**
- (ii) core temperature below 35 °C ;
 individual is sleepy / very relaxed / disorientated / other symptom ;
 drop in temperature reduces kinetic energy of reactants / enzymes /
 AW ;
 therefore enzyme controlled reactions slow / AW ;
 metabolism slows / BMR drops ;
 AVP ; e.g. no ATP for cells **3 max**
- (iii) wrap in a blanket / survival sack ;
 supply a hot water bottle ;
 provide body heat ;
 warm IV fluid / warm drink ; **R hot**
 no hot drinks until warmer ;
 warm up slowly to avoid risk of heart attack ;
 do not rub extremities ;
 AVP ; eg no alcohol, no glucose, use an incubator for a baby,
 talk to keep them mentally active **3 max**
- (b) (i) temperature at periphery / AW, affected by environmental temperature /
 ora ; **1**
- (ii) can only reach / measure, (peripheral) sites near core ;
 eg / oral / rectal / axillary / tympanic membrane / AW ;
 ref to type of thermometer; eg infrared, Hg in glass, digital probe
R alcohol **2 max**
- (c) (i) at air temperature of 5-20 °C ;
 oxygen consumption / metabolic rate, falls ;
 comparative figs to illustrate, both axes ;
only penalise once for lack of units
 directly proportional ;
 stable / constant / AW, from 20 °C ; **3 max**
- as metabolic rate drops ;
 (when cold) need, more heat / thermal energy / thermogenesis ;
 to maintain body temperature ;
 therefore respiration / metabolic rate, increases ;
 oxygen is required / aerobic respiration ;
 oxygen is the terminal H⁺ / electron acceptor ;
 during the production of ATP ;
 energy released as heat energy ;
 homeostatic / negative feedback ;
 AVP ; **4 max** **5 max**

- (ii) spirometer ;
 filled with medical grade oxygen ;
 timed ;
 as oxygen inhaled trace drops down ;
 the difference between the peak of the trace at the start and at the end
 is equivalent to oxygen consumption ;
 AVP ; e.g. ref to soda lime,
 ref to nose clip,
 watch the machine,
 ref to kymograph

OR

- Douglas bag ;
 collects expired air over unit time ;
 volume oxygen in known volume, expired air ;
 measured with oxygen probe ;
 volume oxygen in same volume, atmospheric air also calculated ;
 difference between two gives oxygen uptake ;
 AVP ; eg detail about Douglas bag (airtight, 3 sub-units)

OR

- AVP ;
 AVP ;

3 max

Total

19

- 7 (a) (i) 1 a delay before the flow of urine begins / hard to pass urine / AW ;
 2 interrupted / slow, flow of urine / AW ;
 3 greater frequency / urgency of urination / AW ;
 4 needing to pass urine during the night ;
 5 urinary retention even when bladder is full ;
 6 a feeling that the bladder has not emptied fully ;
 7 incontinence / dribbling ;
 8 AVP ; eg pain on urination, feeling of swelling **3 max**
- (ii) mass of cells self contained / AW / not dividing uncontrollably ;
 does not spread to other organs ;
 not malignant ;
 no metastases ;
 not cancer ;
 AVP ; **2 max**
- (b) (i) an enzyme ;
 a protein ; **1 max**
- (ii) may fit into active site ; *ecf receptor if identified as a hormone*
 compete with substrate / testosterone, for active site ;
 fit away from active site ;
 alter the shape of the active site ;
 so that substrate / testosterone, will not fit / no dihydrotestosterone ;
 AVP ; eg ref to types of inhibition **4 max**
- (iii) ICSH / LH stimulates testosterone production ;
 from the Leydig / interstitial cells ;
 therefore less testosterone, less enlargement (of prostate) ;
 changed into / precursor, of dihydrotestosterone ;
 AVP ; **2 max**

- (c) PSA (blood) test ;
blood from vein in arm ;
prostate specific antigen ;
level over 4 ng per cm³ ;
no ejaculation for 48 hours / 2 days before the test ;
ejaculation raises PSA levels ;
could be BPH / not very reliable ;

OR

biopsy ;
TRUS / transrectal ultrasound ;
local anaesthetic ;
ultrasound used to guide needle ;
ref to many needles to take a number of tissue samples simultaneously
/ AW ;
take small sample of tissue ;
examine tissue under a microscope ;
cells have large nuclei ;

OR

rectal examination ;
enlargement 'craggy' / uneven ;
ultrasound scan ;
CT / MRI scan to check for metastases ;
to confirm the diagnosis ;
AVP ; eg detail

3 max

Total

15

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

Unit Threshold Marks

<i>Unit</i>		Maximum Mark	a	b	c	d	e	u	entry
2856	Raw	60	49	44	39	34	30	0	1760
	UMS	90	72	63	54	45	36	0	
2857	Raw	60	52	47	42	37	32	0	331
	UMS	90	72	63	54	45	36	0	
2858B	Raw	120	96	84	72	61	50	0	78
	UMS	120	96	84	72	60	48	0	
2866	Raw	90	60	51	42	33	25	0	748
	UMS	90	72	63	54	45	36	0	
2867	Raw	120	87	77	67	57	47	0	12
	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	0.0	8.7	26.1	52.2	91.3	100.0	25
7886	0.0	33.3	66.7	83.3	100.0	100.0	7

3886

25 candidates aggregated this series

7886

7 candidates aggregated this series

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

Statistics are correct at the time of publication

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