OCR
RECOGNISING ACHIEVEMENT

GCE

Human Biology

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

Combined Mark Schemes And Report on the Units

January 2006

3886/7886/MS/R/06J

Oxford Cambridge and RSA Examinations

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MARK SCHEME ON THE UNITS

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REPORT ON THE UNITS

Mark Scheme 2856
January 2006

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking point
	;	=	separates marking points
	NOT	=	answers which are not worthy of credit
	R	=	reject
	( )	=	words which are not essential to gain credit
	___	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	A	=	accept
	ora	=	or reverse argument

Question		Expected Answers	Marks
1	(a)	A nucleus / nuclear envelope/ nuclear membrane ; **R** envelope or membrane unqualified B chloroplast / granum / thylakoid; **R** chlorophyll C rough endoplasmic reticulum / RER / cisterna ; **R** ribosome	3
	(b)	packaging / modification / secretion / specific function in context e.g. lysosomes ; **A** correct ref to antibodies, production of vesicles **R** transport / makes proteins / storage	1
	(c)	through intrinsic proteins / (transporter/carrier) proteins spanning membrane / A/W ; facilitated diffusion ; ref to active transport ; correct ref to concentration gradient ; pinocytosis ; AVP ; e.g. ref to ATP / energy, sodium-potassium pump, ref to respiration, correct ref to passive process, 'ping-pong', allostery, ref to specificity **R** ref to osmosis, exocytosis, phagocytosis	3 max
			[Total: 7]

Question			Expected Answers		Marks
2	(a)	(i)	ciliated epithelium;		1
		(ii)	D cilia ;	**R** hairs, cilia hairs	
			E basement membrane ;	**R** cell /plasma membrane, plasmalemma, phospholipid bilayer	
			F mucus / mucin ;	**R** goblet cell	3
		(iii)	54000/80 or 55000/80 ; 675 or 688 ;	*ecf; correct method wrong measurement correct answer to whole number ; ;*	2
		(iv)	(secretion / production of) mucus ; by goblet cells ; glycoprotein ; qualify mucus ; e.g. sticky / slimy traps/captures, bacteria / viruses / pathogens ; **R** engulfs cilia waft / beat , mucus to exterior / AW ;		
			R ref to dirt / dust, ref to mucus / cilia killing, cilia trapping		3 max
	(b)		treat patients with antibiotics / named e.g. streptomycin, isoniazid, rfiampicin, pyrazinamide, ethambutol ; DOTS / description of ; isolate patients ; vaccination programme / immunisation / ref to BCG ; AVP ; e.g. contacts tracing / screening programme / chest x-ray / HIV qualified / education / ref to reduced overcrowding		
			A ref to testing / screening, of milk/cattle		
			R descriptions of disease and mechanisms of transmission, ref to ELISA test, ref to smoking ref to sanitation, ref to water quality, penicillin, medicines, better living conditions		2 max
					[Total: 11]

Question **Expected Answers** **Marks**

3 (a)

type of stored blood product	use
	transfusion / treat <u>anaemia</u> / major blood loss / AW ; **R** sickle cell anaemia, ref to iron deficiency
(fresh / frozen) plasma / factor VIII or IX ;	
<u>whole</u> blood ;	

3

(b) temperature / pH ; 1 max

temperature
enzymes are proteins ;
high temperature denatures, proteins / enzymes ; **R** kill / death
3^0 structure / AW ;
correct ref to <u>active site</u> ;
freezing or below can cause ice crystals destroy, cells / cell membranes ;
reduces metabolic rate / AW ;
low temperature, reduces kinetic energy / AW ;
ref to correct temperature of 4 ^{0}C;less chance of clotting (at higher temperature) ;
AVP ; e.g. ref to hydrogen bonds

OR

pH
must be at optimum for enzymes ;
use buffer ;
H bonds / ionic bonds / disulphide bonds broken ;
correct ref to <u>active site</u> ;
tertiary structure / AW ;
enzymes less able to catalyse a reaction / AW ;
AVP ; e.g. coagulation of globular proteins **4 max**

(c) calcium / Ca^{2+} / Ca; **A** vitamin K **1**

continued

Question 3 cont'd **Expected Answers**

(d) bind with enzyme **;**
may alter shape of active site **;**
allosteric **;**
easier for substrate to combine with (active site) **;** promotes the formation of ESCs **;**
AVP **;** ; e.g. cascade reaction, positive feedback, ref to prosthetic groups, reduces activation energy, conversion of fibrinogen → fibrin

A allow error carried forward from part (c) **2 max**

[Total: 10]

Question	Expected Answers	
4	*CPR:*	
1	place heel of hand, in correct position / correct ref to position e.g. <u>on</u> sternum **;**	
2	(position is) 2 fingers from the base of the rib cage **;**	
3	place heel of other hand on top of first hand **;**	
4	lock elbows and position shoulders over hands **;**	
5	press down to move breastbone (2 inches or 4 / 5 cm) **;**	**R** 2cm
6	compress 15 times **;**	**A** 30 times
7	at rate of 100 per min;	
8	after (compressions), (open airway again) provide 2 breaths **;**	**A** one breath
9	repeat **;**	
10	AVP **;** e.g. look for signs of breathing (prior to CPR), look for signs of circulation, check for blockages in the airway, give 2 breaths before CPR, place in recovery position (if breathing/circulation returns) *5 max*	
	defibrillator:	
11	apply pads to patients bare chest **;**	
12	check chest for any dangers e.g. chest must be dry / no water **;**	
13	stand clear whilst machine is analysing **;**	
14	ensure no one is touching the patient **;**	
15	if machine recognises a shockable rhythm apply shock / AW **;**	
16	continue until patient has a pulse **;**	
17	or the resuscitation is stopped **;**	
18	CPR must be maintained in between shocks **;**	
19	AVP **;** e.g. shave the chest area, using two people, move to recovery position (if not awarded above), ref to fluttering, correct ref to different charges, ref to <u>electric</u> shock <u>restarting</u> heart *5 max*	**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.	
(b) (i)	pushes blood into upper body / heart / AW **;** prevents pooling of blood in legs **;** **R** ref to back flow/ prevents blood flow to legs increases peripheral resistance **;** **R** increases BP unqualified AVP **;** ref to effect on veins / venous return	**2 max**
(ii)	brain / heart tissue, cannot be starved of <u>oxygen</u> **;** <u>glucose</u> to brain / heart **;** to <u>improve</u> circulation **;**	**1 max**
		[Total: 11]

Question			Expected Answers	Marks
5	(a)	(i)	ester ; **A** covalent	1
		(ii)	condensation ; **A** esterification	1
		(iii)	glycerol ; **R** triglyceride	1
	(b)		saturated have no double bonds ; in the hydrocarbon / fatty acid chain ; straight chain vs. kinks ; AVP ; e.g. correct ref to state at room temperature / melting point *ora for unsaturated.* **A** labelled diagram **R** ref to hydrogen <u>molecules</u>	1 max
	(c)		it is insoluble / lipoproteins make it 'soluble' / non-polar / hydrophobic / AW ; **A** soluble in lipids **N** ref to transport	1
	(d)		low density lipoproteins / LDLs ; high density lipoproteins / HDLs ; 2 max *LDLs linked to* take cholesterol / lipids, to the artery <u>walls</u> / from liver ; ref to the formation of plaques / AW ; *HDLs linked to* take cholesterol / lipids , away from artery <u>walls</u> / dying cells / to liver ; offers protection / AW ; AVP ; e.g. correct ref to VLDLs, relative risk to CHD i.e. ref to ratio of HDL:LDL	4 max
				[Total: 9]

Question			Expected Answers	Marks
6	(a)		L first ; M last ; J and K in correct order ;	3
	(b)	(i)	1.2 / 3.4 X 100 ; 35.3 ; *correct answer only;;* *not to one decimal place 1 max;*	2 max
		(ii)	severe ; *ecf*	1
	(c)	1	neutrophils / phagocytes, to inflamed lung ;	
		2	(release of) elastase ;	
		3	destruction/break down, of elastin ;	
		4	alveoli do not stretch and recoil / AW ;	
		5	alveoli burst / AW ; **A** alveolitis	
		6	surface area reduced (for gas exchange) ;	
		7	bronchioles, collapse / walls thicken / become fibrous ;	
		8	capillaries, collapse / AW ;	
		9	alveoli separated from capillaries ;	
		10	AVP ; ; e.g. anti-elastase inhibitor, protease, irreversible tissue damage (caused by action of protease)	
			N ref to cilia and bronchitis	5 max
	(d)		bronchitis ; bronchial carcinoma / cancer; bronchiolitis ; (severe) asthma ; alveolitis ; asbestosis / named occupational cause ; AVP ; aspergilosis, pneumoconiosis, named occupational cause e.g. farmer's lung	
			R CHD, smoking / smoker's cough, lung disease, TB	1 max
				[Total: 12]

PAPER TOTAL 60

Mark Scheme 2857
January 2006

/	/	=	alternative and acceptable answers for the same marking point
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Abbreviations, annotations and conventions used in the Mark Scheme	R	=	reject
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Question	Expected Answers	Marks
1 (a)	production of genetically identical cells ; growth (of tissues) ; to replace / replicate / form new, cells / tissues ; to repair (tissues) ; **R** repair cells throughout life / AW ; maintain chromosome number ;	**2 max**
(b) (i)	**P** anaphase ; **Q** metaphase ;	**2**
(ii)	cytokinesis ; constriction, cell membrane / AW ; invaginates / nips cell in middle / AW ; refs to cell division furrow ; cytoplasm / organelles separate (into two cells) ; **A** answers from an annotated diagram **R** any ref to chromosome or organelle replication	**2 max**
		[Total: 6]

Question		Expected Answers	Marks
2	(a)	measured length approx. 80mm / 8cm (accept range between 70-90mm / 7-9cm) ; *may be implied* real length 80 x 2 = 160 (accept range between 140-180) ; week 16 – 22 ; *ecf*	**3 max**
	(b)	biparietal diameter / AW e.g. diameter of head ; **R** head circumference AVP ; e.g. length of long bones	**1**
	(c) **(i)**	premature / early birth ; lower birth weight / IUGR / AW ; (late) miscarriages ; perinatal death ; developmental abnormalities / e.g. heart abnormalities, poor brain development / AW ; AVP ; e.g. nicotine addiction, hypoxia / low oxygen, nicotine speeds up heart rate **R** postnatal defects	**3 max**
	(ii)	restriction of blood flow / narrowing of blood vessels due to nicotine ; in placenta / umbilical cord ; less O_2 / nutrients ; less O_2, carried by Hb due to CO ; irreversible ; less respiration ; less energy ; for growth ; AVP ;	**4 max**
			[Total: 11]

Question		Expected Answers	Marks
3	1	**phagocytes / neutrophils ;**	
	2	**chemotaxis** / move to wound site **;**	
	3	engulf pathogens / AW **;** R virus	
	4	destroyed / hydrolysed / digested / **opsonisation** / AW **;**	
	5	**basophils**, release **histamine** / promote inflammation **;**	
	6	**APC / macrophage ;**	
	7	detail of action, e.g. ref to **MHC** / displays antigen on cell surface membrane **;**	
	8	accurate ref to **Th** cell **;**	
		4 max	
		***A** in any correct context*	
	G1	detection of **antigen** / foreign protein **;**	
	G2	antigens bind to antigen receptors on lymphocytes **;**	
	G3	**clonal selection** / described **;**	
	G4	**clonal expansion** / described **;**	
	G5	**memory cells ;**	
	G6	memory cells provide (rapid) protection against same pathogen **;** 4 max	
	B1	**B lymphocytes** in correct context **;**	
	B2	**humoral**, immunity / response / described **;**	
	B3	**differentiate** into **plasma cells** / AW **;**	
	B4	plasma cells secrete / produce, **antibodies ;**	
	B5	antibodies specific to antigen / pathogen **;**	
	B6	detail of action **;** 4 max	
	T1	**cell mediated**, immunity / response / detects pathogens inside cells **;**	
	T2	destroys infected cells **;**	
	T3	T-lymphocytes recognise / detect, viruses **;**	
	T4	T-lymphocytes bind to antigen on cell surface AW **;**	
	T5	**Tk / Tc** , produced **;**	
	T6	detail of action e.g. release lytic enzymes / chemical messengers / **cytokines** / named chemical **;** 4 max	
	1	AVP **;** e.g. correct ref to specific / non-specific immune response, extra detail,	
	2	AVP **;** *(to be used as appropriate)*	**7 max**
		QWC – clear well organised using specialist terms;	**1**

At least three of the terms indicated in bold : phagocytes, neutraphils, chemotaxis, opsonisation, basophil, histamine, APC, macrophage, MHC, named T cell, antigen, clonal selection, clonal expansion, mitosis, memory cells, B lymphocyte, humoral, differentiate, plasma cells, antibodies, cell mediated, cytokine.

[Total: 8]

Question		Expected Answers	Marks
4	(a)	mutation / described ; **R** refs to chromosome of proto-oncogenes ; formation of oncogenes ; uncontrolled cell division / mitosis / cell cycle ; AVP ; e.g. detail on control of cell division	**2 max**
	(b)	*Allow answers in either section*	
	(i)	more men than women are diagnosed / die from, lung cancer ; male lung cancer rates / deaths decreasing ; female rates / deaths increase until 1989 ; then plateau / AW ; gradual increase overall ; mortality and incidence trends for lung cancer are very similar ; in all cases incidence is higher than mortality ; *3 max*	
	(ii)	social / historical reasons ; male smoking on decline / more men quitting smoking / ora ; health campaigns take effect / AW ; less effective in women / women do not stop ; diagnosis too late to prevent death / time delay between diagnosis and death ; **R** refs to effect of treatment 3 max	
		figs to support both axes ; *penalise once only for no units or wrong units* AVP ;	**5 max**
	(c)	lung cancer rare in non-smokers ; lung cancer increases as number of cigarettes smoked increases / AW ; ex smokers less likely to die of lung cancer ; AVP ;	**2 max**
	(d) (i)	<u>ionizing</u> / gamma radiation / X-rays ; targeted at tumour / site of cancer ; destroys DNA / kills cancer cells ; daily treatment ; AVP ; detail e.g. shrink tumour before surgery, remove stray cancer cells	**2 max**
	(ii)	drugs / named ; injected / delivered IV ; targets dividing cells ; interval treatment over several months ; AVP ; ref to specificity, side effect	**2 max**
	(iii)	named complementary technique ; description of effect ;	**2 max**
			[Total: 15]

Question		Expected Answers	Marks
5	(a)	(bacterium) not killed by antibiotic / AW ; **R** immune **R** disease killed (bacterium) contain genes, which make them resistant / protect them from effects of antibiotic ; AVP ; e.g. bacterium is mutated	**1 max**
	(b)	hospital staff wash / decontaminate hands, often / between patients ; alcohol-based hand rub ; high / improved standard of ward hygiene / described ; uniforms / laundry washed in hot temperatures ; infected patients isolated ; use catheters only when essential ; screening for MRSA in selected groups ; AVP ; e.g. barrier nursing, vacuum controlled / negative air pressure AVP ; e.g. sterile equipment, narrow spectrum antibiotics, decrease use of antibiotics **R** take full course	**3 max**
	(c)	elderly may have weaker immune systems / compromised immunity / AW ; MRSA more likely to cause serious illness / death / AW ; (in) individuals already weakened by illness ; AV ; e.g. ref to protein diet	**2 max**
	(d)	**1** antibiotic kills antibiotic-sensitive bacteria / AW ; ora e.g. not all destroyed **2** remaining bacteria have some resistance ; **3** 'R' plasmids / genes / explained ; **4** resistant bacteria now multiply / reproduce rapidly ; **5** new bacterial cells also resistant / have 'R' plasmids ; **6** correct ref to natural selection / less competition ; **7** antibiotic is selective agent ; **8** ('R') plasmids enable plasmid transfer / horizontal transmission ; **9** increase in population of resistant bacteria / resistant bacteria dominant form ; **10** AVP ;	**4 max**
			[Total: 10]

Question		Expected Answers	Marks
6	(a)	gene / cistron / coding strand ;	1
	(b)	transcription ; (DNA strand) acts as template ; mRNA nucleotides brought to the template / AW ; complementary base pairing ; **R** matching / corresponding mRNA differs / U instead of T ; A pairs with U / T pairs with A / G pairs with C / C pairs with G ; forms polynucleotide / polymer, m RNA ; detail ; e.g. unzipping / limitation of gene, hydrogen bonding etc AVP ;	3 max
	(c)	translation ; 3 bases / triplet (code) ; mRNA codons ; codes for specific amino acid ; tRNA anticodons ; **R** matching / corresponding pair up with complementary / described, codon on mRNA / AW ; sequence of codons on mRNA determines sequence of amino acids / AW ; AVP ; e.g. peptide bonds, condensation	3 max
	(d) (i)	point / gene / substitution ;	1 max
	(ii)	different / no amino acid ; different / no polypeptide chain / protein / enzyme ; different 3D / tertiary structure ; change in active site ; accumulation of reactant / no product (of enzyme) ; substrate doesn't fit / no enzyme-substrate complex ;	2 max
			[Total: 10]

PAPER TOTAL 60

Mark Scheme 2858/01
January 2006

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Question		Expected Answers	Marks
1	(a)	condensation reaction ; water removed / AW ; between carboxyl group (of one amino acid) ; (and) amino group (of next amino acid) ; peptide bond / link formed ; AVP ; e.g. ref to ribosomes / tRNA / formation of a dipeptide **A** marks on fully annotated diagram	**3 max**
	(b) **(i)**	alpha, helix ; *treat beta pleated sheet as neutral* **A** α	**1**
	(ii)	hydrogen (bond) ;	**1**
	(iii)	hydrogen ; ionic / salt bridges / AW ; Van der Waals / hydrophobic (interactions) ;	**3 max**
	(iv)	fits / binds to, (membrane) receptors / AW ; **R** ref to enzymes and active site	**1**
	(c) **(i)**	**X** phospholipids bilayer / AW ; **R** membrane **Y** protein / transport protein ;	**2**
	(ii)	(glucose) going from high to low concentration ; no ATP / being shown ; AVP ; e.g. correct ref. to co-transport	**1 max**
	(iii)	*Do not credit twice any marking point already given in (ii)* (glucose) going from high to low; no ATP / energy used / passive;	**1 max**

continued

Question 1 cont'd **Expected Answers**

(d) **A** from labelled diagram

(formation of) glycosidic bonds **;**
(between) glucose molecules **;**
alpha (glucose) **;**
(between) carbon atoms 1 and 4 **;**
(and) carbon atoms 1 and 6 **;**
(1,6 bonds) branched structure **;**
compact / AW **;**
ref short chains / 10-20 glucose units **;**
AVP **;** e.g. granules, ref to no of branches **4 max**

(e) osmosis **;**
glucose is soluble / solute ;
(increase in glucose) lowers water potential (inside lens) ;
(water) moves down (water potential) gradient / AW **;**
ref partially permeable membrane **;**

N references to 'cell' **3 max**

(f) biosensor / description **;**
immobilised (enzyme) **;**
named enzyme **;**

Benedicts / described **;**
detail **;**

AVP **;** e.g. transducer, reaction/process detail, correct ref to Clinistix ®, ref to fasting **2 max**

[Total: 22]

Question			Expected Answers	Marks
2	(a)		(mumps) virus ; (TB) bacteria / *Mycobacterium tuberculosis / M. tuberculosis / M. bovis* ; (rubella) virus ;	3
	(b)	(i)	diseases which must (by law) be reported, to (governmental) authorities / AW ;	1
		(ii)	sudden increase in the incidence of a disease / AW ; e.g. telescoped in time and space **R** outbreak unless qualified	1
		(iii)	(infectious disease) is always present in the prevalence pool / population / sporadic occurrence / AW ;	1
		(iv)	attenuated / AW strain of the organism / AW ; organism capable of reproducing (in host) ; **R** a small dose	1 max
	(c)	(i)		
		1	(first response) slow(er) / ora	
		2	correct ref to time from graph ;	
		3	fewer antibodies / ora ;	
		4	correct ref to antibody concentration ; 2 correct data quotes required	
		5	clonal selection ;	
		6	ref to antigen presentation ;	
		7	(specific) T cells and B cells located ;	
		8	clonal expansion ;	
		9	(T cells and B cells) divide by, mitosis ;	
		10	plasma cells/ B cells, produce antibodies ;	
		11	ref to memory (T and B) cells ;	
		12	(second response faster as) more (specific) cells available / AW ;	
		13	fewer divisions necessary (for clonal expansion / to produce antibody levels) ;	
		14	correct ref to cytokines ;	
		15	no symptoms develop ;	
		16	AVP ; e.g. detail of APC action, ref to cytokines, detail of T cell action, ref to slower decline in antibody concentration (after booster)	7 max
		(ii)	boosters not given ; ref (protein) malnutrition ; ref immunodeficiency / AW; e.g. HIV infection ; AVP ; e.g. pathogen mutates , ref to vaccine not working, vaccine not stored correctly	1 max

continued

Question 2 cont'd **Expected Answers**

(d)

	natural, passive **;**
	artificial, passive ;
	natural active **;**

3

(e) **(i)** 93/100 x 10.9 **;**
10.1 **;** **A** 10.137 **2**

(ii) introduction of MMR / triple vaccine **;**
adverse publicity **;**
concern about side affects / AW **;**
AVP **;** e.g. thinking that measles is no longer a risk **1 max**

(f) (long term) immunity requires, lymphatic tissue / lymphocytes **;**
long term immunity is active immunity / AW **;**
mass / amount of lymphatic tissue / AW, increases very fast/faster / AW, than other tissues **;**
ref to data from graph **;** e.g. lymphatic tissue grows almost twice as fast
AVP **;** e.g. ref to specificity, clonal selection **2 max**

[Total: 23]

PAPER TOTAL 45

Mark Scheme 2866
January 2006

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Question	Expected Answers	Marks
1 (a)	(blood vessels / arteries) in the brain / affects the brain ; **or** coronary arteries / vessels (heart) ; bleeding / haemorrhaging / clotting / described ; **or** blocking blood flow to heart muscle ; leads to paralysis / loss of memory / speech impediment / AW ; **or** death of heart muscle / myocardial infarction ; AVP ;	**2 max**
(b) (i)	increases (with age) ; before 75, Denmark highest incidence ; up to 54, England constant ; after 75, Australia highest / Denmark lowest ; use of comparative figs ; AVP ;	**3 max**
(ii)	saturated fat in Danish diet / little saturated fat in Australian diet ; more unsaturated fat in Australian diet / less unsaturated fat in Danish diet ; more dairy products eaten in Denmark ; more fish than red meat eaten in Australia ; more, fruit / vegetables / fibre, eaten in Australia ; higher blood cholesterol in Danes ; higher alcohol consumption in Denmark ; more people smoke in Denmark ; more obesity in Denmark ; genetic differences ; ref. to exercise / ref to climate affecting activity levels ; high(er) salt intake in Denmark ; AVP ;	**3 max**

continued

Question 1 cont'd **Expected Answers**

(c) *similarity*
need rest / oxygen / BP monitoring**;**
need rehabilitation **;**
AVP **;**

difference
need to distinguish between clot or haemorrhage **;**
do not immediately use clot-busting drugs / named drug **;**
occupational therapy / physiotherapy / speech therapy **;**

angioplasty **;** **R** surgery
bypass operation **;**
heart transplant **;**

AVP **;** **2 max**

[Total: 10]

Question **Expected Answers** **Marks**

2 (a)

spermatogenesis	*oogenesis*
occurs in testes	occurs in ovary ;
onset at puberty	onset before birth ;
continuous	monthly / cyclic ;
four gametes (per germ cell)	one gamete / egg / ovum (per germ cell) ;
fully differentiated at end of process	not fully differentiated ;
mature sperm produced / division completed	secondary oocyte produced / division division not completed / completed at fertilisation ;
no polar bodies / equal divisions	polar bodies / unequal divisions ;
millions / large numbers produced	only one, at a time / per month / fixed number;
involves ICSH / testosterone	involves FSH / oestrogen and progesterone ;
accessory cells / Sertoli cells	follicle cells ;
production, throughout life / ceases at 65+ / in old age	production ceases at menopause / 45-60 ;
AVP ;	

2 max

(b) (i)
A head ;
B middle piece / mid-section ;
C axial filament / microtubules ;
D nucleus ; **4**

(ii) acrosome ;
contains hydrolytic / named ;
enzyme ;
digests / breaks down, path through zona pellucida ; **3 max**

(iii) provide energy / ATP ;
allow tail to beat / for swimming ; **2 max**

continued

Question 2 cont'd **Expected Answers**

(c) *causes*

1 low sperm count / absence of sperm **;**
2 sperm non-motile / AW**;**
3 due to, infection / mumps / chlamydia **;**
4 abnormal testes development **;**
5 genetic defect / named **;**
6 testicular cancer **;**
7 radiation / chemotherapy **;** **R** cancer treatment unqualified
8 abnormal sperm / AW **;**
9 obstruction of sperm ducts **;**
10 testosterone deficiency **;**
11 effects of smoking, etc **;**
12 failure to capacitate ;

treatment

13 IVF described **;**
14 further detail (e.g. sperm selected) **;**
15 ISCI described **;**
16 donor sperm insemination **;**
17 surgical sperm retrieval **;**
18 surgical methods to remove obstruction **;**
19 drug therapy to improve sperm production **;**
20 sperm washing **;**

21 AVP **;** (e.g. impotence / vasectomy / GIFT qualified / ZIFT qualified)

max 4 marks on each section

7 max

QWC - legible text with accurate spelling, punctuation & 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: 19]

Question			Expected Answers	Marks
3	(a)	(i)	(as CO_2 concentration increases) more oxygen released / lower affinity for O_2 ;	1
		(ii)	carbon dioxide forms carbonic acid ; produces H^+ (ions) ; haemoglobinic acid forms / H^+ ions bind to haemoglobin ; oxygen released ; Bohr effect ; AVP ; (e.g. further detail) **A** marks from equation	3 max
	(b)	(i)	95 - 75 ; 20 <u>%</u> ; *correct answer only = 2 marks* max 1 for ecf	2
		(ii)	lowers affinity for oxygen / more oxygen released ; moves dissociation curve to right ; ref. to comparative figures ;	2 max
	(c)		low partial pressure oxygen at high altitudes / AW ; more, erythropoietin / EPO ; more <u>red</u> blood cells / faster production / reticulocytes ; more haemoglobin ; more oxygen, carried / released, to, body / tissues / cells ; ref. sustaining <u>aerobic</u> respiration ; more energy release / ATP production ; less lactate / oxygen deficit delayed / AW ; AVP ; e.g. increased VO_2 max / kidneys secreting EPO **R** refs to lung capacity, muscle size, capillary network , myoglobin , cardiac output	5 max
				[Total: 13]

Question			Expected Answers	Marks
4	(a)	(i)	**A** axon terminal / synaptic knob / bulb **;** **B** cell body / centron **;** **C** node of Ranvier / axon **;** **D** myelin sheath / Schwann cell **;**	**4**
		(ii)	sensory / afferent **;**	**1**
	(b)	(i)	+ 30 mV **;**	
		(ii)	- 70 mV **;** *only penalise once for lack of units in (b)*	**2**
	(c)		***X*** **1** **axoplasm** / inside, low Na^+ and high K^+ / tissue fluid / outside, high Na^+ and low K^+ **;** **2** ref. to **voltage gated channels ;** **3** **sodium channels** open **;** **4** (sodium) ions move into neurone **;** **5** by **diffusion** / described **;** **6** **electrochemical gradient**; **7** **depolarisation** / described **;** *4 max* ***Y*** **8** sodium channels close **;** **9** **potassium channels** open **;** **10** (potassium) ions move out of neurone **;** **11** **repolarisation** / described **;** **12** potassium channels close **;** *4 max* **13** 3 Na^+ out and 2 K^+ in **;** **14** **active transport ;** **15** AVP e.g. **hyperpolarisation**, use of figs **;** *4 max if **X** and **Y** wrong way round*	**6 max**
			QWC - clear well organised using specialist terms	**1**
			At least 4 of the terms shown in bold: axoplasm, voltage gated channels, sodium channels, diffusion, electrochemical gradient, depolarisation, potassium channels, repolarisation, active transport, hyperpolarisation.	
	(d)	(i)	can specialise / differentiate into many cell types / AW **;** pluripotent **;** by switching genes on or off **;** depends on environment / AW **;** can replicate repeatedly **;** by mitosis **;** large nuclear : cytoplasmic ratio / AW **;**	**3 max**

continued

Question 4 cont'd **Expected Answers**

(ii) cells obtained from umbilical cord / blastocyst / bone marrow / chorionic villi / embryo / foetus **;**
own cells or compatible donor **;**
place in culture medium / AW**;**
incubate at controlled temperature / 37^{o}C **;**
add growth factors / hormones / named example **;**
to trigger neurone formation / AW **;**
implanted in brain **;**
introduction of genes / gene manipulation **;**
AVP **;** (e.g. any ref. to environment influencing outcome) **4 max**

[Total: 21]

Question			Expected Answers	Marks
5	(a)		*exercise that* improves cardiovascular system / heart ; improves lung function / appropriate ref. to breathing / AW ; increases, heart rate / breathing rate, for minimum of 20 minutes ; ref. red muscle fibres used ; use of oxygen / aerobic respiration (in muscles) ; 80% of max. heart rate ; AVP ; e.g. named example	**3 max**
	(b)		increase in, heart rate / stroke volume / cardiac output ; increase in, blood pressure ; more complete emptying of ventricles ; arterioles dilate / vasodilation, in muscle / skin; arterioles constrict / vasoconstriction, in gut ; increased blood flow through muscles ; ref. to adrenaline ; AVP ; e.g. correct ref to nitrous oxide secretion	**4 max**
	(c)	**(i)**	glycolysis / glycolytic pathway ;	**1**
		(ii)	2 ;	**1**
	(d)		active site / groove, has specific shape ; only glucose and ATP / substrate, fit(s) ; **R** same shape enzyme-substrate complex ; breaking / formation, of bonds in substrate ; glucose and ATP brought into close proximity / AW ; induced fit / described ; lowers activation energy ; AVP ; e.g. forms H bonds	**4 max**
	(e)		reduced NAD is oxidised / reduced NAD donates hydrogen ; **R** NAD oxidised hydrogen transferred to pyruvate / pyruvate reduced / pyruvate is H acceptor ; (to form) lactate ; lactate dehydrogenase ; in cytoplasm / not in mitochondria ; AVP ; **A** marks from flow diagram / equation	**3 max**
				[Total: 16]

Question		Expected Answers	Marks
6	(a)	**X** photosynthesis ; **Y** respiration / decomposition ;	**2**
	(b)	(rain)forests act as, carbon sinks / reservoirs ; less carbon dioxide used in photosynthesis ; more carbon dioxide released (as a result of burning) ;	**2**
	(c)	soil contains <u>decomposers</u> ; extracellular digestion ; by fungi / bacteria ; ref. enzymes ; leaf litter provides respiratory substrate / leaf litter decomposes ; release of CO_2 by respiration ; AVP ; (e.g. ref. to soil fertility / other organisms)	**3 max**
	(d)	blanket of CO_2 allows, high energy / short λ rays, to enter atmosphere ; reflected, lower energy / longer λ rays, cannot escape ; 'global warming' / temp. of atmosphere rises ; melting of (antarctic / polar) ice caps ; expansion of water in oceans / rising sea levels ; flooding of low-lying areas ; climate changes / named / described ; affects on distribution of, plant / animal, species ; effect on agriculture ; pests may increase in warmer conditions ; AVP ; e.g. more tropical pests in temperate climates	**4 max**
			[Total: 11]

<u>PAPER TOTAL 90</u>

Mark Scheme 2867
January 2006

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking point
	;	=	separates marking points
	R	=	reject
	( )	=	words which are not essential to gain credit
	___	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	A	=	accept
	R	=	reject
	ora	=	or reverse argument

Question			Expected Answers	Marks
1	(a)	(i)	**A** destruction of cartilage at ends of bones / AW ; **R** thinner unless qualified **B** reduced in synovial fluid / AW / accurate alternative ; **C** erosion / roughness of bone ends ;	3
		(ii)	bone deformities rub against soft tissue / ligament / membrane / bone ; friction increases in joint AW ; receptors / nerve (endings) stimulated ; impulses to brain ; AVP ; **R** inflammation	2 max
		(iii)	**A** no, loss of cartilage / cartilage not involved ; **B** no, reduction of synovial fluid / synovial fluid not affected ; **C** no, rough bone ends / bone deformities ; AVP ; e.g. bone thin / bone shatters / AW	3 max
	(b)	(i)	**1** women have less bone mass than men, until 35 years of age / ora / decreases **2** continuously in men ; **3** in women, increases until 45-50 years ; **4** then declines rapidly ; **5** drops below that of men at 65-70 years / ora ; **R** 90 **6** bone density less at 65-70, than at 20 years ; **7** in men decrease with age ; **8** comparative figs from both axes ; **9** AVP ;	3 max
		(ii)	women are protected by oestrogen / ora ; inhibits parathormone ; ref menopause ; (after menopause) oestrogen withdrawn ; parathormone mobilises bone calcium ; men have greater initial bone mass ; deposit bone calcium faster ; lose it more slowly than post-menopausal women ; AVP ;	3 max
				[Total: 14]

Question			Expected Answers	Marks
2	(a)	1	leaking capillaries / large molecules pass through ;	
		2	protein in urine ;	
		3	decrease in plasma protein ;	
		4	red blood cells in urine ;	
		5	scar tissue ; **R** inflammation as in stem	
		6	decrease in blood flow through capillaries ;	
		7	decrease in surface area ;	
		8	decreased, glomerular filtration rate / ultrafiltration / AW ;	
		9	increased blood urea ;	
		10	loss of nephrons ;	
		11	water retention / oedema / swelling of tissues ;	
		12	increased BP / heart failure ;	
		13	AVP ; e.g. ref to angiotensin	**4 max**
	(b)		infection ; urinary reflux / AW ; increased BP ; genetic cause (of kidney disease) ; AVP ; e.g. (uncontrolled) diabetes (mellitus), side effect of surgery	**2 max**
	(c)		pressure to donate organs after trauma / AW ; cost compared with other treatments ; organs for sale ; pressure on potential living donors / AW ; problems associated with genetic screening (for kidney damage) ; AVP ;	**3 max**

continued

Question 2 cont'd **Expected Answers**

(d) **1** kidney machine **;**
2 vein and artery sewn together **;**
3 to create pocket / fistula **;**
4 blood from vein **;**
5 pumped into machine to increase pressure ;
6 warmed **;**
7 Al^{3+} / Ca^{2+} removed **;**
8 (dialysis) membrane (in machine), differentially / selectively permeable **;**
9 separates blood and dialysis fluid **;**
10 plasma proteins / rbc's, stay in blood **;**
11 urea diffuses out **;**
12 also (excess) mineral ions / named **;**
13 excess water removed **;**
14 by osmosis **;**
15 (concentration of dialysis fluid) maintains gradients in correct direction / described / AW **;**
16 detail on composition of dialysis fluid **;**
17 accurate ref to countercurrent **;**
18 anticoagulant / heparin added **;**
19 blood filtered before returned **;**
20 haemoglobin sensor detects damage to rbc's **;**
21 AVP **;** e.g. blood passes through several times,
dietary mineral supplements may be taken,
time consuming **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: 17]

Question			Expected Answers	Marks
3	(a)	(i)	diabetes mellitus ; genetic / congenital ; AVP ;	1 max
		(ii)	further from capillaries / humours ; less oxygen / glucose ; correct ref to surface area to volume ratio ; removal of toxic waste ; AVP; e.g. thicker / more protein in centre / AW ;	2 max
		(iii)	**1** daycase / surgery ; **2** eye drops dilate pupil ; **3** local anaesthetic ; **4** tiny incision in eye surface ; **5** electric current / probe/ AW vibrates at high frequency, liquefies lens ; **6** phacoemulsification ; **7** lens removed ; **8** artificial lens inserted ; **9** AVP ; ; e.g. sedated, microsurgery / described, stitches not necessary, **10** takes 15-20 minutes, eye drops to prevent infection, ref to care of eye ref to selection of appropriate lens	6 max
		(iv)	artificial lens does not <u>accommodate</u> ; should get fatter / AW, for near vision / thinner for distance vision ; bends light rays more / less ; AVP ; e.g. no lens / (damaged) suspensory ligament	2 max
	(b)	(i)	less chance of forming / will not form cancer / tumour / AW ; will not pass on mutations ; AVP ;	1 max
		(ii)	*tissue A* muscle / nerve / any named non-dividing somatic cell ; *tissue B* germ cells / gamete forming cells / stem cells / dividing layer of skin or other tissue qualified ;	2

continued

Question 3 cont'd **Expected Answers**

(iii) has a specific ;
active site ;
forms enzyme substrate complex ;
which matches with nucleotide sequence ;
on telomere / DNA ;
and specific free nucleotides ;
decreases activation energy ;
forms bond between nucleotides ;
sugar phosphate bond ;
AVP ; **4 max**

[Total: 18]

Question	Expected Answers	Marks
4 (a)	*variable + reason two marks. Mark first two variables.* BMI ; ref to surface area and heat loss ; age ; metabolic rate decreases as age increases ; activity ; regular exercise would also increase mitochondrial efficiency ; AVP ; ; e.g. gender, diet AVP ; ; man has a higher metabolic rate / women has less heat loss because of adipose tissue / fat	**4 max**
(b)	(in a cold climate) heat loss greater than heat production / imbalance idea / AW ; more oxidative phosphorylation / ATP production ; energy not incorporated into ATP / AW ; transferred as thermal / heat, energy / AW ; **A** released carried in blood / maintains temperature ; ref to, compensates for heat loss / balance ; AVP ; e.g. increase in substrate increases thermal energy **R** more respiratory substrate unqualified	**3 max**
(c)	**A** *ora where appropriate* **1** mutation had a <u>selective</u> advantage ; **R** helps to keep warmer – in stem **2** e.g. of biochemical effect of mutation ; **3** warmer individuals more active / AW ; **4** more likely to survive ; **5** reproduce ; **6** mutation passed on to offspring ; **7** by mother / matrilineal ; **8** mother more likely to provide more milk (because she is warmer) / AW ; **9** offspring more likely to survive if warmer ; **10** allele frequency increased ; **11** became dominant form ;	**4 max**

continued

Question 4 cont'd **Expected Answers**

(d) lower down food chain **;**
energy lost at each step / trophic level, (in food chain) **;**
by respiration / movement / excretion **;** 2 max
but more fibrous content / AW **;**
less digestible **;**
energy wasted **;**
ref to relative energy value of carbohydrate, fat and protein **;**
AVP **;** e.g. less fruit and vegetables in environment **3 max**

(e)
1 causes **calorigenesis** / **thermogenesis** **;**
2 **hypothalamus** stimulated by drop in (environmental) temperature **;**
3 to release **TRH / TRF** **;**
4 stimulates **anterior pituitary** to release **TSH** **;**
5 stimulates thyroid gland to release thyroxine **;** 3 max

6 controls the **metabolic rate** **;**
7 increases metabolism of fat and glucose **;**
8 as **respiratory substrates** / AW **;**
9 increases rate of glucose / oxygen uptake **;**
10 increases rate of enzyme action **;**
11 in **electron transport** chain **;**
12 increases respiration / ATP production **;**
13 thermal energy is a byproduct of ATP production / AW **;** **A** heat
14 AVP **;** e.g. **portal vein**
15 AVP **;** **7 max**

QWC - clear, well organised using specialist terms; **1**

At least 4 of the terms shown in bold : calorigenesis, thermogenesis, hypothalamus, TRH / TRF, anterior pituitary, TSH, metabolic rate, respiratory substrate(s), electron transport,

[Total: 22]

Question	Expected Answers	Marks
5 (a)	*key* Let the normal allele = X^H , let haemophilia allele = X^h ;	
	parental genotypes mother X^H X^h, father $X^H Y$;	
	gametes X^H X^h X^H Y ; could be taken off punnet square	

	X^H	X^h
X^H	$X^H X^H$	$X^H X^h$
Y	$X^H Y$	$X^h Y$ haemophiliac son ;

correct box ;

A alternative form if clear

4 max

probability 0.5 / 1 in 2 ;
OR
0.25 / 0.5 x 0.5 / 1 in 4 / 1 : 3 ;

if justified 0 .5 probability of inheriting X^H and 0.5 of inheriting Y ; **5 max**

only penalise once if not sex linked
ecf up to 3 max

(b) blood becomes more viscous / AW ;
applies pressure ;
blood flows more slowly ;
enzyme action slows ;
named enzyme ;
as kinetic energy reduces ;
not clotting / coagulation ;
detail ; e.g. vasoconstriction occurs
AVP; **3 max**

continued

Question 5 cont'd **Expected Answers**

(c) *Mark (i) and (ii) together*

(i) different supplies of blood (vessels) / AW **;**
e.g. muscle bleeds more heavily than the ankle / other valid e.g. **;**
bleeding of head more dangerous / heavier **;**
drug slower to reach head **;**
bleeding into a joint is very painful **;**
AVP **;** e.g. must maintain blood flow to the brain / AW 3 max

(ii) blood would create pressure in the brain **;**
brain damage **;**
loss of function **;**
e.g. of function **;**
AVP **;** **5 max**

(iii) larger / more reliable / AW, supply **;**
no risk of blood borne infections / HIV / other e.g. **;**
purer **;**
AVP **;** **2 max**

[Total: 15]

Question		Expected Answers	Marks
6	(a)	(the frequency of) alleles in a given population ; remains constant ; from one generation to the next ; providing no mutation / migration / selection / change in conditions ; AVP ; ref to population size, random mating	3 max
	(b)	$q^2 = 4\%$; **R** 4% alone, given in question $4\% = 0.04 / \frac{4}{100}$; $q = (\sqrt{0.04})$; $= 0.2$; $p = 1 - 0.2$ / ecf ; $p = 0.8$; $= 2 \times 0.8 \times 0.2$; $= 0.32$ / ecf ; answer = 32(%) ;	6 max
	(c)	*A ora throughout* Hb^S confers resistance to malaria ; no selective advantage, for heterozygote, in UK ; because no malaria ; $Hb^S Hb^S$ may die of sickle cell disease ; before reproducing / AW ; Hb^S allele becomes less common / frequency decreases ; AVP; e.g. Hb^AHb^S survive both malaria and sickle cell disease ;	3 max
	(d)	Hardy-Weinberg principle assumes that there is no selection ; if allele frequency has changed ; HW equilibrium shifts / AW ; indicates that there is a reason / conditions have changed / e.g. of condition ; gives a clue for further research / AW ; could look for a selective agent / other e.g. ;	2 max

continued

Question 6 cont'd **Expected Answers**

(e) (i) only one base is substituted ;
there is no frame shift ;
the rest of the sequence is unchanged / one codon (only) different ;
only one amino acid different ;
AVP ; **2 max**

(ii)

1 different R groups ;
2 form different bonds / named ;
3 haemoglobin <u>molecule</u> has a different 3D shape / folds differently / AW ;
4 haemoglobin crystallises at low oxygen tensions / concentrations ;
5 forms fibrous strands / less soluble ; 2 max

6 ref to cell membrane of rbc reflects changed shape / decreases surface area to volume ratio of cell / AW ;
7 less O_2 picked up / AW ;
8 sickle cells block capillaries ;
9 have normal cells too ;
10 because heterozygous ;
11 AVP ; e.g. correct ref to hydrophobic / hydrophilic amino acids
intense pain from lack of O_2 / accumulation toxic waste 2 max **4 max**

[Total: 20]

Question			Expected Answers	Marks
7	(a)	(i)	fasting blood glucose ; patient tests blood after fasting overnight / 12 hours ; plasma glucose over 7.0 mmol / 126mg / dL on two successive tests / occasions ; AVP ; 2 max fasting first sample ; glucose tolerance test ; patient is fed a measured dose of glucose ; blood tested for glucose at regular intervals ; AVP ; e.g. for 2-3 hours 2 max	**4 max**
		(ii)	modify her diet / e.g. of modification e.g. less refined CHO / named, more slow release CHO / named, more fruit and vegetables, less fat ; lose weight ; more exercise ; AVP ; e.g. drugs to increase sensitivity to insulin	**2 max**
	(b)	(i)	protein ; mutation could alter shape receptor ; DNA inherited ; AVP ;	**2 max**
		(ii)	insulin forms complex / matches receptor / AW ; complex initiates signal ; causes vesicle to move to cell surface membrane ; vesicles / glucose channels, contain carrier proteins ; fuse with it membrane / AW, to increase glucose uptake ; **R** glucose channel in cell surface membrane	**3 max**
	(c)		fat incorporated / AW, into LDL ; deposited on artery walls ; as cholesterol ; forms plaques ; intima swells ; artery occluded / AW ; AVP ;	**3 max**
				[Total: 14]

PAPER TOTAL 120

REPORT ON THE UNITS
January 2006

Chief Examiner's Comments

This was the second examination session when the supporting text books were available to the candidates on the Human Biology Course.

The text books endorsed by OCR for this specification are:

Human Biology for AS Mary Jones, Geoff Jones CUP 2004 ISBN 0 521 54891 8

Human Biology for A2 Mary Jones, Geoff Jones CUP 2005 ISBN 0 521 54892 6

The use of the text book has clearly helped to inform candidates and teachers on the approach and ethos of the specification as well as giving a good basic understanding of the topics covered. All Centres offering the specification are advised to obtain some copies of these textbooks. It is however, important to note that the textbook is **not** the specification and wider reading of both textbooks and relevant web based resources is also encouraged. The use of this additional material gives some opportunity for independent learning and improves the skills needed for the pre-release Case Studies paper 2858/01 and the A2 Extended Investigation 2868. Teachers are encouraged to note the extensive list of resources in the specification on pages 56 – 58. More up to date lists of resources are provided at INSET.

As would be expected in a January series the candidature for 2856 and 2857 included many candidates resitting from AS. This strategy is well informed as it allows candidates to improve their UMS scores and also helps their preparation for the synoptic elements of 2866 (when taken). There was strong evidence that the majority of candidates resitting AS modules showed significant improvement. It was pleasing to note that many of the candidates entered for the January session for 2866 were clearly well prepared.

Teaching tip

While teaching A2 theory topics it is useful to encourage candidate to explore possible synoptic links to AS topics. This can usefully be done as brainstorms or spider diagrams.

Candidates may still perceive Human Biology to be more accessible than Biology. This perception however is based on the title alone and this examination series as the others that preceded it showed that the level of demand of the questions and the answers required in the mark schemes, were comparable to Biology in every way.

However this specification continues to be well received; candidates and teachers have clearly enjoyed the innovative approach and the intrinsic interest of the topics. The enthusiasm and thorough learning of the content of the specification shown by many of the candidates, has made it possible for them to achieve their full potential. We would like to congratulate Centres on this positive approach.

Centres should be aware that there is a balance to be struck between the newer more directly relevant sections of the specification and the core factual content that underpins it. There was evidence that many of the weaker candidates had significant gaps in their knowledge. This specification is set in a 'real world context' and for that reason, practical procedures as indicated in the learning outcomes, will be tested on theory papers.

Centres are reminded that definitions should be learned for all the words emboldened in the specification. The endorsed textbook covers these as would any good dictionary of biology.

Teaching tip

Weaker Candidates benefit from high levels of repetition and reinforcement. Starter activities can be used to provide frequent recaps of previously covered material. Key terms and definition can be recapped as matching pairs activities. This activity lend itself to delivery using ILT particularly hot potatoes software www.halfbakedsoftware.com

Understanding the questions

As an Advanced Level Science, Human Biology requires an appropriate standard of literacy, which includes the specialist vocabulary associated with the learning outcomes. The use of command words in questions was not universally understood by candidates, page 91 of the specification provides a comprehensive glossary of the main command words used.

Teaching tip

Encourage candidates to study the glossary on page 91 of the specification. Present data to students and get them to produce separately a description and an explanation of the data presented. This will reinforce to candidates that there are clear differences to descriptions and explanations.

There was evidence that candidates did not always read the questions properly. Candidates in some instances showed evidence that they had skimmed questions before responding. This was noticed particularly when responding to data; e.g. on 2866, Austria was quoted rather than Australia. The question stem frequently gives a clue as to the answer required. Direct quotes from the stem are not credited as answers.

Teaching tip

Activities that directly address the reading skills of candidates are encouraged. Simple activities include allowing candidates a block of text for a defined time period and then asking them to recall exactly what is contained. Any intervention that allows candidates to realise that they do not necessarily read accurately are welcomed.

Information, Tables and Graphs

Graphs on the question papers are now drawn on a 2mm graph paper grid. This is to allow candidate to accurately quote figures with units from graphs. Candidates would find it useful to use a ruler to draw intercepts on the graph so that they might read the figures off accurately.

Mathematical requirements

The mathematical questions in this series were attempted by the majority of the candidates which was pleasing to see. However in general these questions highlighted that this is not an area of strength for many candidates. Centres are reminded that the specification gives details of the mathematical skills required on page 89. As such, these specific skills are likely to be tested on theory papers at the appropriate level. Candidates are not required to remember complex formulae but are required to be able to use them appropriately. It was pleasing to see accurate calculations form the Hardy-Weinberg equations on 2867.

Teaching tip

The rearrangement of observed, actual and magnification causes difficulties to many of the weaker candidates. The golden triangle for this equation can be memorized using the mnemonic **o**ld **a**ged **m**an.

Presentation

The standard of presentation is not assessed generally when marking Human Biology papers. However, this session produced a number of examination papers which were very hard to read. The QWC for spelling, punctuation and grammar requires the answer to be legible and this mark is lost too frequently on a QWC that is awarded more often than not. The Examiners try extremely hard to decipher such papers but the risk to the candidate is obvious.

In particular scripts where the candidate has written an extra line in-between every dotted line are especially difficult to read. Diagrams and flow charts are acceptable parts of a candidate's response but should always be annotated. Bullet points are also acceptable, but these should be qualified to make the answer clear, rather than a simple one word list.

INSET

OCR is offering a programme of in-service training for teachers on the delivery of the specification, during the Autumn 2006 and Spring 2007 terms. The booklet containing details of these INSET courses will arrive in Centres during the Summer term 2006. Further information may be obtained from the OCR website (www. ocr.org.uk) or by telephone on 0121 628 2950. A summary of the courses offered are given below.

Human Biology INSET Programme 2006-2007

- **A beginner's guide to delivering and assessing OCR's AS Level Human Biology (3886)**
- **A beginner's guide to delivering and assessing OCR's A2 Level Human Biology (7886)**
- **Delivering and assessing OCR's Human Biology AS/A Level Coursework (3886/7886)**
- **Improving the teaching and learning of OCR's AS/A Level Human Biology (3886/7886)**

2856 Blood, Circulation and Gaseous Exchange

General Comments

There were some excellent responses to this paper. Many teachers had taught the specification well and candidates had learned and understood it thoroughly. However it was noticeable that some Centres had not taught all the topics and so their candidates were unprepared for some questions. It was also clear that some candidates had not had enough experience of answering examination questions at AS standard, so that in some cases, their answers were vague and their knowledge of the facts was sketchy. Although the use of this examination may be a useful 'mock', the Examiners are sure that teachers will consider carefully the disheartening effect of failure at this early stage in an A Level course.

Comments on Individual Questions

Q.1 This was often well answered and many high marks were scored.

(a) The most common error was to give the wrong name to the cue letters.

(b) Weaker candidates stated that Golgi 'transports', 'makes' or 'stores' protein. The emphasis should be on modification and / or packaging of protein. Some were completely confused and gave 'energy storage' or 'dealing with bacteria'.

(c) Many good, clear accounts of facilitated diffusion and active transport were seen. Some candidates saw the word water and described osmosis. Candidates must be drilled in reading the entire stem of the question before launching into an inappropriate answer.

Q.2 Some major gaps in knowledge and the correct use of biological terminology were exposed by this question.

(a) (i) Very few candidates could recognise and name ciliated epithelium correctly. Many simply called it 'epithelium' or 'epithelial cells'.

(ii) Many candidates recognised cilia, although they were often called 'cilia cells'. Candidates should be aware that 'hairs' is not acceptable terminology at AS level. Few recognised 'basement membrane', but most correctly identified mucus.

(iii) This section was very poorly answered, with most candidates scoring zero. Most knew the correct formula, but could not apply it correctly or could not do the arithmetic. Very large numbers of candidates could not convert cm or mm to micrometres correctly. It is clear that candidates need as much training as possible in the manipulation of this equation.

Teaching tip

Use the approved textbook for AS Human Biology, Human Biology for AS, Jones and Jones, CUP 2004, ISBN 0 521 54891 8. Practise using the formula for size calculations and ask candidates to do the SAQ section on page 5. Find questions on actual size and magnification from recent Human Biology or Biology papers such as Health and Disease to revise this skill.

(iv)There were many excellent answers to this. However, 'hairs' is not acceptable for cilia, and sloppy wording must be avoided. For example, mucus does not engulf anything, nor does it kill bacteria; cilia do not trap dust or bacteria, and 'infections' is too vague a term to score marks.

(b) It was clear that many candidates had little awareness of this topic. TB is clearly and comprehensively covered in the approved textbook mentioned above. It should be noted that this textbook is not the specification however, and the Examiners are always pleased to see evidence of further interest and knowledge. It is expected that candidates should know the facts. Vague statements like 'better living conditions' or 'better housing' should be discouraged, and 'better sanitation' or 'stopping smoking' are not ways of preventing TB.

Q.3 Candidates who failed to score well did so because of lack of factual knowledge and by giving unscientific statements about enzyme characteristics and actions.

(a) Whole blood for transfusion was the least frequently scored mark. Maybe candidates thought that this was too obvious to be considered for a mark. Some candidates confused anaemia with sickle cell anaemia.

(b) Most candidates chose temperature as their condition to be controlled. Candidates should be aware that blood is stored at much lower temperatures than those normally optimal for enzyme action, so 'body temperature' or '37^{o}C' failed to score marks. An alarming number of candidates believe low temperatures denature enzymes, and that enzymes 'die' or are 'killed'. The Examiners are sure that teachers will ‘hammer away’ at these misconceptions.

(c) Calcium ions were the answer most frequently given.

(d) Many candidates showed very good knowledge and understanding of the blood clotting mechanism and gave excellent answers.

Q.4 Candidates found this question challenging and many scored very poorly.

(a) There were two main difficulties with this question. First, many candidates did not answer the question, giving explanations for the reasons behind CPR and defibrillation, rather than describing the procedures as was required. Second, and much more worryingly, very many candidates had completely wrong information about the procedures, and especially about CPR. The most common errors were incorrect placing of the hands on the chest, incorrect ratio of compressions to breaths, the belief that CPR can restart the heart (very unlikely) and that compressions assist breathing / ventilation. The commonest misconception about defibrillation was that it acts like the SAN.

At the least, candidates must be familiar with the relevant sections in the approved textbook, *Human Biology for AS*. Preferably, they should have been introduced to the most recent (8th edition) *First Aid Manual*. Better still they may have received instruction from a fully qualified first aid trainer or appropriate medical practitioner.

Teaching tip

The best option of all is successfully to have completed a first aid course. Teachers and candidates may find the following websites useful:

http://kidshealth.org/parent/firstaid or
http://www..bhf.org.uk/publications

Video clips of chest compressions can be ordered from this second website.

Teachers should be aware that the Resuscitation Council of Great Britain has issued new guidelines for CPR in their 2005 Protocol. Many medical professionals are currently using this, or a modified version of it, and it will be taught to the general public from 2006 onwards by St. John Ambulance first aid trainers. Details of the protocol and an explanation of the rationale behind it are available on http://www.resus.org.uk

Teachers and candidates should also note that in a piece of extended writing of this type the use of numbered or bullet points is recommended as a way of expressing facts clearly and in logical order. Candidates will not be penalised, provided that spelling, punctuation and grammar are of acceptable quality. They should also be aware that text language is completely unacceptable.

(b) (i) Many candidates simply repeated the wording of the question. Few stated that extra pressure on the limbs aids venous return, and weak candidates suggested cutting off the blood supply to the legs.

(ii) Vagueness and imprecision were the causes of lost marks. Maintenance of the oxygen and / or glucose supply to the heart and / or brain was required here.

Q.5 It would seem that biochemistry topics leave some Human Biology candidates floundering.

> **Teaching tip**
>
> Teachers and candidates may find the website http://www.chemsoc.org/networks/learnet/cfb useful. It is excellent for biochemistry, pitched at the correct level and has interactive animations to make a (difficult?) topic accessible.

The biochemistry content of this specification fulfils the criteria which QCA require for all Biology specifications. It is however, accessed in a way that makes its relevance and importance to humans clear and to this extent may be taught and examined in a more 'candidate friendly' manner.

(a) Most candidates were able to recognise and name 'condensation'; some scored 'glycerol', but few knew that the bond was an 'ester bond'.

(b) More able candidates explained C-C double and single bonds clearly. Others scored by referring to the numbers of hydrogen atoms. The incorrect use of the word 'molecule' (of hydrogen) and vagueness like 'fully soaked with hydrogen' failed to score.

(c) Many candidates do not know that cholesterol is insoluble in water.

(d) There were some very good, clear and detailed accounts of LDLs and HDLs and their effects. Some candidates misinterpreted the question and described the structural make-up of the molecules rather than their physiological effects. Weak candidates were imprecise about where cholesterol is deposited.

Q.6 (a) Many got the sequence, especially for J and K, wrong.

(b) (i) and (ii) In this calculation, most candidates scored full marks and had no difficulty in identifying the category. A few failed to round their answer up as requested and therefore lost a mark.

(c) There were some excellent, detailed, clear and logical accounts. Less effective answers described the effects of smoking, damage to cilia and over-production of mucus. The topic is clearly and fully described in Mary and Geoff Jones: *Human Biology for AS*, and candidates should know this.

(d) Bronchitis and/ or asthma frequently scored a mark. Common errors were TB and smoking.

2857 Growth, Development and Disease

General Comments

This paper produced a wide range of marks and provided a positive examination experience for the majority of candidates. Questions 3 and 4 were particularly mark yielding although there is still room for improvement on the interpretation of data questions. These should be practised as part of the continuous revision process.

A number of candidates are leaving blank spaces rather than attempting to answer the question. This makes it impossible for an examiner to exercise judgment in an attempt to maximise a candidate's marks.

Comments on Individual Questions

Q.1 This question was answered well across the ability range.

(a) The majority of candidates scored full marks for 1(a) but a few failed to gain any marks because they confused mitosis with meiosis. A small number of candidates stated that 'mitosis repairs cells' which was not allowed. They need to state 'repairs tissues' or 'replaces cells'.

(b) (i) Many candidates scored full marks for this question but a few failed to correctly identify the stages of mitosis. The mistakes made suggested that candidates had assumed the stages were in the correct order which was not the case.

> **Teaching tip**
>
> After teaching the topic, set students an activity to test their understanding. Give students a set of separate diagrams / photomicrographs / images of different stages of mitosis and ask them to identify the stages and put them in the correct order. Ask them to identify the distinguishing feature of each stage from the diagrams / photomicrographs / images

(ii) Some candidates answered this question well, using the term cytokinesis and then going on to describe how it results in the division of the cytoplasm into two new cells. However, many were unsure of this and confused cell division with the stages of mitosis, giving answers such as the formation of the new nuclear membranes or some just stated that the cell splits into two which was not sufficient.

Q.2 The Examiners were surprised that very few candidates scored well on this question.

(a) The majority of candidates had very little difficulty with the calculation and gained full marks. A small number of candidates didn't understand what was meant by the crown to rump measurement and a few were unable to take account of the scaling factor and so failed to gain marks.

(b) Most candidates failed to answer often incorrectly stating 'head circumference' instead of the required 'head or biparietal diameter'. Some Centres had obviously emphasised this learning outcome (5.2.2.1.b) and a small number of candidates from these Centres gained the mark.

(c) (i) Many candidates were unsure of the specific effects of mothers smoking heavily on an **unborn** child. A few candidates gained full marks by including answers such as: 'lower birth weight'; 'more likely to be born early'; 'more likely to miscarry'; 'lower blood oxygen level'; or 'poor development of heart or brain'. However, many candidates included birth defects that have other specific causes or described the underlying causes without naming the effect and so failed to gain marks.

(ii) Many candidates found this section difficult. The marks were for explaining in detail how nicotine and carbon monoxide may restrict the amount of oxygen and nutrients getting to the unborn child and linking this to less energy from respiration and less nutrients being available for growth. Candidates were confused about the relationship between the mother and the unborn child and many went on to describe the short and long term effects of smoking on the lungs of an adult smoker. Common misconceptions included tar entering the lungs of the foetus, and even smoke crossing the placenta.

Teaching tip

Find out what students know about the physical relationship between the mother and the unborn child. Sort out any misconceptions and make sure they understand the role of the placenta. Let them explain how a developing foetus gets what it needs for growth before discussing how the mother's heavy smoking may make this process less efficient.

Q.3 Most candidates scored well on this mark yielding question. Many candidates who dealt with this topic in a logical and organised manner, produced above the maximum marks and described all aspects of the immune response in detail. There were some excellent answers to this question.

The good answers included descriptions of: roles of macrophages in antigen presentation; roles of neutrophils in phagocytosis; clonal selection and clonal expansion of B and T lymphocytes and the role of memory cells in developing immunity. Many answers distinguished clearly between the role of B lymphocytes in humoral immunity and T lymphocytes in cell-mediated immunity. They included descriptions of how B lymphocytes differentiate into plasma cells that produce antibodies specific to the antigen and the names and roles of different types of T lymphocytes (T killer / cytotoxic cells, T helper cells). A few answers also explained how T killer cells kill cells infected by a virus (pathogen) by injecting toxic chemicals into the cell.

A few candidates were thoroughly confused and although they included a few of the key terms they used them incorrectly and failed to gain any marks.

Most candidates gained the QWC mark and included at least three key terms.

Q.4 This too was a mark yielding question.

(a) The majority of candidates scored full marks on this question.
There was good use of the terms proto-oncogene and oncogenes.
However, a small number of candidates stated that the *cell mutates* which was not really the point of the question.

(i) and (ii) Many candidates managed to score full marks on 4(b) by producing a good analysis and explanation of the data. The majority of those who did not, could not distinguish between the terms ‘describe’ and ‘explain’. Although sections (i) and (ii) were marked together there was a maximum mark for each of the descriptive and explanatory points. Many candidates included above the maximum for descriptive points but were less able to score marks for the explanation.

Marks were also given for accurate figures quoted to support the descriptive points. A surprising number of candidates could not read the coordinates to a sufficient degree of accuracy or quote the units correctly. Explanatory points included social or historical reasons for the data, the differing impact of advertising campaigns on men and women and the fact that diagnosis usually results in death.

Teaching tip

When teaching data interpretation, generate a set of statements (some describing trends and some explaining trends) about a set of data presented as a graph or table. Ask students to work in small groups to sort the statements into descriptions and explanations. Then let each group feedback and explain what they decided about 2 or 3 of the statements. Follow this by giving students a different set of data and asking them individually to describe and explain the trends it shows.

(c) Some candidates scored full marks for this section with answers such as 'the more cigarettes smoked the more cases of lung cancer' or 'lung cancer is rare in non-smokers'. It was however clear that many candidates did not understand the meaning of the word 'epidemiological' (learning outcome 5.2.3.3 (e)).

It is desirable that candidates should be able to distinguish between experimental evidence such as experiments on dogs and the action of nicotine and tar, and epidemiological evidence based on data collection.

(d) (i) Many candidates had little difficulty in scoring two marks for this section. Most concentrated on the application of ionizing radiation to the tumour site and the killing of cancerous cells. There were a few answers which noted that the treatment is daily or that it shrinks the cancer before surgery. Some students didn't state the type of radiation used and so failed to gain two marks.

(ii) A pleasing number of candidates were able to name appropriate cytotoxic drugs which target dividing cells. Side effects were also mentioned.

(iii) The answers to this section were very varied. Marks were scored for a named complementary therapy plus a description of its possible effects. Some candidates simply provided a vague list of examples of complementary techniques and others obviously did not understand what the term meant.

Care was taken not to credit misleading effects such as complementary therapies being an alternative way of curing cancer.

Q.5 Many candidates were able to score almost full marks for this question but rather more either lost marks through lack of accuracy or were thoroughly confused by the topic. Some candidates confused the terms 'antibiotic' and 'antibody'.

(a) The use of the word 'immune' in this context was not acceptable. A statement such as 'the antibiotic had no effect' is hardly the case. Examiners were hoping that candidates would provide a simple statement to the effect that the bacterium was not killed by the antibiotic. A number of candidates scored the mark by referring to the resistance gene.

(b) Candidates had little difficulty with this section and provided accurate answers which usually scored full marks.

(c) Almost all candidates stated that elderly people had 'weaker immune systems'. Fewer scored the second mark for noting that MRSA could therefore be fatal or that hospital patients are already weakened by illness.

(d) Many candidates found this section on learning outcome 5.2.3.1 (e) very difficult. The marks were for an understanding of the selective effect of the antibiotic on the bacterial population. A significant number of candidates stated that the bacteria mutate *after* surviving the antibiotic attack rather than possessing the resistance gene before this event so that they survived. There were few mentions of horizontal transmission of plasmids containing the resistant gene.

Teaching tip

As a revision exercise give students pairs of words that are often confused (such as immune and resistant, B and T lymphocytes, antibiotic and antibody, antigen and antibody) and ask them to distinguish between the terms.

Revise GCSE level understanding of natural selection when teaching the development of antibiotic resistance.

Q.6 There were a few good A grade answers to this question but most showed a poor understanding of this topic.

(a) There were a number of correct answers but many candidates failed to interpret Fig. 6.1 accurately and gave vague answers such as DNA strand or polynucleotide. Examiners expected candidates to recognize that Fig. 6.1 shows the area of DNA which acts as the template for RNA and therefore must be a gene or cistron for a polynucleotide.

(b) Most candidates described the DNA as unzipping or breaking the hydrogen bonds. Knowledge of transcription was less accurate although a large number of candidates mention complementary base pairing. Fewer went on to describe the pairs or to state that RNA had uracil instead of thymine. Several candidates confused, transcription with translation and replication.

(c) Answers to this section indicated confusion between the location of amino acids and bases. Answers lacked precision tending to give the terms codon and anticodon without describing which form of RNA applied to each.

(i) Most candidates identified this as a point or gene mutation or a substitution. For those who did not read the question carefully and thought that it was a deletion, the subsequent question was credited in the light of the answer given in (i).

(d) (ii) Many candidates scored two marks for this section but few referred to the subsequent change in the tertiary structure and the loss of the active site in the enzyme.

Teaching tip

Recognise that this topic is difficult and that the nature of the underlying concepts of transcription and translation are very similar so it leads to confusion. Take every opportunity to define and use the key terms. Use video clips and animations of transcription and translation to show the dynamic nature of the processes. Encourage students to present this information in their own words by producing their own models of the process. Assess the students' level of understanding of these processes internally and go over misconceptions.

2858 / 01 Case Studies

General Comments

All the candidates entering this unit on this occasion were re-sitting – there were no new candidates. The Examiners saw some excellent responses and there was clear evidence that some Centres and candidates had spent considerable time researching the two case studies and combing through for 'links' to areas of the specification.

There were some excellent descriptions of the structure of proteins and glycogen and the primary and secondary immune response. Clearly this approach is not adopted by all Centres and candidates and this was obvious from the responses to Question 1in particular.

Biochemistry is a difficult topic and Case Study 1 gave clear 'pointers' to protein and glycogen and also to osmosis – another area of difficulty. Case Study 2 used several terms given in the specification, for example endemic, and was almost entirely based on immunity and the different ways in which it is acquired.

Teaching tip

Use EITHER one Case Study OR a section of a longer Case Study. Candidates can be provided with copies of the specification and, working in groups, MAP THE LINKS as a spider diagram or a mind map. Revision can then be structured to ensure that each of these links is adequately covered.

Comments on Individual Questions

Q.1 (a) Good candidates were able to obtain full marks on this section very easily by describing the formation of peptide bonds in a condensation reaction. Several illustrated their answers and it was possible to gain full marks with a fully labelled diagram. The commonest mistake was to repeat the first paragraph in the case study and describe the structure of the insulin molecule. Some candidates described protein synthesis and while this was credited, unless reference was made to peptide bond formation, it was not possible to score full marks.

(b) (i) The diagram given in the case study clearly showed that **most** of the molecule consists of alpha helix and many candidates correctly identified this as such. Some went on to add 'and beta pleated sheet'. Whilst they were not penalised for this, this response alone was not credited. Weaker candidates identified the structure as 'double helix' or 'helix' unqualified and were not credited.
(ii) Most candidates identified the hydrogen bond correctly here although weaker candidates gave peptide bond or covalent bond as a response.

(iii) Good candidates were able to identify the remaining three bonds involved in the tertiary structure although even here the term 'covalent' bond' was used despite the fact that the only covalent bond involved in tertiary structure, the disulphide bond, was not required. Many weak candidates randomly listed bonds and it was not uncommon to see references to glycosidic, peptide and even ester bonds. The commonest correct response was, again, the hydrogen bond; a case of 'if in doubt, write hydrogen bond' perhaps, but a strategy which paid off in this case!

Teaching tip

For revision try playing BOND BINGO! Write a list of ALL the bonds covered in the specification. Each student picks a list of 5. THEN call out either a description of the bond OR put up a picture OR an example of a molecule which contains a bond. Check that the winners list matches the list you called. This is a good starter or suitable for a plenary session. This activity also lends itself to the use of ILT in the classroom.

(iv) This was a difficult question in that, while several candidates picked up on the concepts of the molecule 'fitting' or 'binding', this was all too often explained in terms of enzymes and active sites and so could not be credited. Correct answers referred to membranes and receptors and these responses were by no means limited to A grade candidates. Again, a case possibly of 'spotting' a potential angle of questioning.

(c) (i) This question was well answered with virtually all candidates labelling Y correctly. However, weaker candidates confused the phospholipids bilayer with individual phospholipids or used the term 'membrane'.

(ii) The direction of movement was spotted by most candidates as going 'from high to low' and while the examiners prefer such an unambiguous response, the terms 'with' or 'against' the concentration gradient were credited if it was clear which direction was being described.

(iii) A surprising number of candidates referred to facilitated diffusion as 'using less energy' than active transport and some suggested that active transport 'just goes through the phospholipids bilayer; there are no proteins used'.

(d) This question proved surprisingly difficult for all but the most able candidates The specification requires candidates to be able to describe the structure of glycogen and it was possible to score full marks by referring to a branched chain of glucose molecules connected by 1,4 and 1,6 glycosidic bonds. Some candidates obtained marks by using well annotated diagrams and space was available on the paper to allow for this. However in some cases, lack of clear annotation or incorrect annotation prevented the marks being awarded. A surprising number of candidates failed to specify that the monomer was glucose with many using the term 'monosaccharide' as if this was synonymous with glucose. Weaker candidates described the properties rather than the structure of the molecule and it was not uncommon to see references to polypeptides and peptide bonds.

(e) In common with the Biology specification, it is expected that candidates should be able to describe osmosis in terms of water potential and many candidates successfully did so. However, many explain the movement of water molecules in terms of 'concentrations' either of water or of the glucose even if 'osmosis' was identified as being the cause of lens distortion. Some candidates described the phenomenon in terms of movement in and out of 'cells' – the situation described in the case study, but providing the terminology was correct, they were not penalised.

(f) It was clear from the responses to this question that many candidates had either used or had seen used a glucose biosensor and Centres are to be congratulated on this. The ethos of the specification is one of applying biological principles and biosensors can be used to illustrate enzyme specificity. Many used the term and went on to give excellent details of the immobilised enzyme involved and the reaction it catalysed. Other candidates, while omitting the terms, could give sufficient detail of the method to be able to score at least one mark. Some candidates confused the technique with the haemocytometer or with the measurement of haemoglobin concentration. This possibly indicates a 'rote learning' approach to the techniques specified in the specification.

Q.2 Generally, performance on Question 2 was better than on Question 1, helped largely by the marks available for accurately describing the immune response graph. Centres are to be congratulated again on developing these skills in their candidates. As with Question 1, it was apparent to the Examiners where Centres had 'used' the case study. There were some good definitions of the terms in question (b) which suggested that some candidates had revised these thoroughly in the light of the case study material.

(a) Rubella and TB are both on the specification and candidates are expected to identify the nature of the causal organism. Using the Case Study to 'research' mumps would have revealed that it is a viral disease and it has been common practice since the inception of this paper to credit additional research where possible.

(b) (i) to (iv) It was unusual even in high scoring candidates to see full marks for the 4 terms required in this section. The terms epidemic and endemic were defined as of either the geographical area covered (confusion with pandemic) or the severity of the disease. It was rare to see the terms 'incidence' or 'prevalence' used in explanations of either term. Definitions of 'notifiable diseases' posed fewer problems – again indication of research perhaps. However, good definitions of what constitutes a live vaccine were few and far between with candidates referring to 'live pathogens' being injected or 'bacteria' being injected without reference to weakened or attenuated strains. Some candidates referred to 'weakened forms of the disease' or 'weakened forms of the antigen' being injected and this was not credited. It was clear that some candidates did not really understand the meaning of 'attenuated' producing answers such as 'the vaccines contains attenuated / killed bacteria' [*sic]*.

(c) (i) Most candidates managed to score some marks here by referring to a 'faster' and 'higher' production of antibodies in the secondary response and illustrating this with reference to the data. Centres are reminded that

comparative statements involving data are normally expected to include 2 X and 2 Y axis references and that rulers should be used to read off the grids accurately. Several candidates failed to read the scale correctly on the Y axis and lost the data marks. Most candidates were able to refer to the production of memory cells after the first response and many answers also commented on the T and B lymphocytes dividing by mitosis or cloning. Good descriptions of antigen presentation, clonal selection and clonal expansion were rare and only the best candidates explained the speed of the second response in terms of the numbers of specific cells available and hence the need for fewer rounds of division. Weaker candidates confused the role of the memory cells ('storing the antibodies) and a few candidates interpreted the primary response in terms of passive immunity with the 'booster' being the first exposure to the vaccine.

(ii) The commonest answer given was to comment on the difficulty following up vaccinations with 'boosters', an explanation which was clearly prompted by the case study.

(d) There was an element of 'guess work' in weaker candidates in identifying the type of immunity being described, but the responses to this question on the whole were excellent with even low scoring candidates often scoring full marks. Despite the exemplar response clearly giving two terms, a few candidates answered in terms of 'active' or 'passive' immunity alone without reference to natural or artificial immunity.

(e) (i) As ever, the calculation proved demanding with only high scoring candidates achieving the marks here. However, it is difficult to imagine how candidates could suggest that the number of children needing to be vaccinated would exceed the number in the population and yet some answer in excess of 10.9 million were given!

(e) (ii) Candidates were clearly familiar with the controversy surrounding the MMR vaccine and this was the most commonly cited reason given. The response of one candidate that parents were concerned that the vaccine might 'increase the risk of the child being artistic [*sic*]' was either a spelling mistake or very profound and was credited!

(f) A number of candidates did not attempt this question, presumably because they did not see it. The examiners were looking for awareness from the candidate that 'long term' immunity is active immunity and involves lymphocytes. Credit was given for comparing the rate of development of the different organs and tissues and / or data quotes. Unfortunately most candidates did not pick up on the word 'ability' to develop long term immunity and responded in terms of the years up to 12 being when most vaccines were given OR when most diseases were encountered.

2866 Energy, Control and Reproduction

General Comments

The overall quality of the responses seen this session was most pleasing. There was evidence that candidates had been able to complete the examination paper in the allotted time and the quality of some of the answers was excellent, indicating some thorough and imaginative teaching.
Many candidates lost marks for the imprecise use of language, rather than because they did not know the required biology and Centres are urged to make candidates aware of the need for appropriate scientific terminology in their responses.
The final question on the paper, which drew on some aspects of plant biology, was generally poorly done and Centres are reminded that all statements on the specification are testable by examination.

Comments on Individual Questions

Q.1 The opening question on this paper is intended to be a gentle lead into the examination and it is hoped that the majority of candidates find most sections of this first question quite accessible. The examiners were disappointed by the generally poor responses to (b)(ii) and (c), but there were some very high quality answers to the other sections of this question.

(a) Most candidates scored the two available marks. There was some confusion over the location of strokes, with a significant number of answers stating that strokes occurred in the heart. Marks were lost by answers that omitted *coronary* from the description of the arteries affected by CHD and the examiners did not credit vague references to 'blocking blood flow *in* the heart'.

(b) (i) There were some excellent answers to this section, with evidence of candidates having been trained to use graphical data and pick out trends from graphical displays. Some very confused answers were also seen in response to this question; a significant number of candidates misunderstood the units on the vertical axis of the graph and quoted figures such as 250,000 rather than 250 per 100,000 of population. A surprising number of candidates referred to the number of strokes in *Austria*, rather than Australia.

Teaching tip

There is likely to be at least one data response question on this examination paper and it is vital that candidates are trained in answering questions of this type. The more different types of graphical display they have seen before, the better and as problems frequently occur with the interpretation of units, this is an area worth highlighting. Candidates should also be encouraged to pick out trends from data and use figures to support their written answers.

(ii) Few candidates scored full marks on this part of the question. The problem with understanding the units on the vertical axis of the graph reappeared here, with many answers suggesting that differences in population size between Denmark and Australia accounted for variations seen in stroke incidence. Some candidates did not limit their answers to the under 75 age group.

Some candidates failed to link there suggestions to a named country, stating merely that 'more exercise' could be responsible. Other responses failed to indicate a direction for the possible causes, for example '*differences* in exercise levels could be the reason'.
Many answers made reference to Australia having a healthier lifestyle, with out any further qualification linking this to lower stroke rates. Very few candidates made reference to saturated fat consumption or other specific dietary factors.

The examiners were impressed by a number of highly imaginative, but sadly incorrect suggestions such as 'Denmark having less oxygen as it was at a higher altitude', 'people in Denmark being worse drivers, so having more head injuries' and 'Danish people being more stressed because they had less sunshine than Australia'.

(c) This part of question 1 was generally not well answered; most candidates suggested the use of clot-busting or blood-thinning drugs as a appropriate treatments for both strokes and CHD, revealing a lack of appreciation that strokes could be due to haemorrhage. Candidates tended to do better on describing differences in the treatments, often gaining credit for stating that specific surgical procedures were appropriate for CHD. Credit was not given however, simply for the use of the word 'surgery', if left unqualified. Some candidates lost marks for suggesting diagnostic, rather than curative procedures in this part of the question.

Q.2 Many candidates scored well on this question, with few demonstrating any misunderstanding of what the question sections were asking for. The extended writing was generally well done, with many scripts scoring the maximum available marks and there was evidence of some excellent teaching of topics such as GIFT and ICSI, with which the candidates had clearly engaged.

(a) Most candidates scored at least 1 mark on this section and many wrote far more valid comparative points than were needed for the available marks. Candidates tended not to use the answer boxes provided correctly, but the examiners did not penalise this. There was evidence of considerable confusion over the terms egg / ovum / oocyte in some answers.

(b) (i) Few candidates were unable to identify the head or nucleus of the sperm cell, although some suggested *genes / DNA* for part D, answers that were rejected by the examiners. The mid-piece and axial filament were seldom identified correctly, with *body* and *tail* being the usual incorrect responses. If the tail was to be identified on a diagram of this type, a bracket along its length would be used on the examination

question.

(ii) Many candidates were able to identify and describe the role of the acrosome with accuracy, although relatively few named the enzymes as 'hydrolytic'. The examiners were looking for 'digestion' of the zona pellucida rather than vague references to a physical 'breaking into' or 'penetration' and although 'cell membrane' (of egg) was accepted, 'cell wall' was not. There were some delightful descriptions of the acrosome as a sort of GPS system in a few of the answers!

(iii) Nearly all candidates scored the 2 marks for this section. The examiners decided not penalise answers that referred to the *production* of energy on this question, but at A2 level, this sort of error is not expected. A minority of candidates did not score the second marking point as their answers merely suggested the energy was required for 'sperm movement' or to 'allow the sperm to travel to the egg'.

(c) The examiners read a large number of excellent answers to this section, with many candidates easily scoring the maximum number of marks. There was evidence of some confusion over the differences between IVF, AI, GIFT, ZIFT and ISCI and examiners did not credit the use of these initials if unqualified by description. A number of candidates incorrectly referred to 'blocked urethra' rather than blocked 'sperm ducts' as a possible cause of male infertility.

The QWC mark was generally awarded except for those answers containing multiple spelling errors, poor grammar or those written entirely in note form without proper sentence construction or bulleted points.

Teaching tip

The construction of a table linking each cause of male infertility with its possible treatment would be a useful exercise to consolidate the teaching of this topic.

Q.3 Many candidates scored high marks on this question; part (c) was particularly well answered with the scripts from some Centres easily scoring the maximum number of available marks – it was clear that students had understood and engaged with the topic of altitude training.

(a) (i) The majority of candidates scored the mark for this question. The examiners were looking for the answer 'haemoglobin has a *lower* affinity for oxygen', but alternative wording was frequently seen and was credited. The most common error seen was when candidates simply wrote 'the Bohr effect'; stating the name of the effect rather than describing it, as demanded by the question.

(ii) Answers to this part of the question tended to fall sharply into those candidates who knew the answer and those who did not, so the scores were generally either full marks or no marks. Common errors included

statements such as 'the carbon dioxide binds to the haemoglobin forming carboxyhaemoglobin' or 'carbon dioxide dissolves to form carboxylic acid', or references to the presence of carbon dioxide making it 'harder for the oxygen to *bind* to the Hb'. Other answers focused entirely on an explanation of the shape of the sigmoid curve, relating this to the binding of the oxygen to the 4 haem groups of each haemoglobin molecule. Hydrogen (rather than hydrogen i*ons*) was not given credit.

(b) (i) Given the straightforward nature of this calculation, a surprising number of candidates failed to score the two available marks. There were the, perhaps predictable, errors in reading accurately from the graph, but additionally it was apparent from the workings shown that many candidates were expecting to calculate a percentage increase (or decrease) despite not being asked so to do. A small minority of candidates lost a mark for forgetting to write the % mark next to their answer.

Teaching tip

A useful exercise is to ask candidates to compare percentage saturations of haemoglobin with oxygen at different concentrations of carbon dioxide, as this not only gives them practice at reading from graphical displays, but also reinforces the effect of an increasing carbon dioxide concentration on the delivery of oxygen to respiring tissues.

(ii) Most candidates scored at least one of the available marks on this part of the question for correctly stating that DPG lowers the affinity for oxygen, but few scored the other mark for expanding upon this point by reference to the right hand shift of the dissociation curve or by using figures to exemplify their assertion.

(c) This part of the question was answered very well by the majority of candidates and the examiners were delighted by the quality of many of the responses seen. There was clear understanding demonstrated of the principles of altitude training, with candidates linking low partial pressure of oxygen to *increased* red blood cell production and so on. A significant number of quite good responses failed to score maximum marks as increased oxygen carriage was not linked to a *destination,* or respiration was not described as *aerobic* and a few candidates simply stated there would be *more* aerobic respiration, rather than describing it in terms of time.

Q.4 Many candidates scored well on parts of this question and problems with the extended writing section tended to be Centre specific.

(a) (i) Few candidates scored all 4 marks for this labelling exercise. Label A caused the most problems with most candidates suggesting either 'dendrite' or 'synapse'. Only about half the candidates scored the mark for correctly labelling the cell body, with the majority of incorrect responses suggesting it was the 'nucleus'.

(ii) Most of the candidates correctly identified the neurone as sensory. The examiners noticed a surprising number of candidates describing the neurone as 'bipolar'. Bipolar may be used as an alternative name for sensory neurones although in the opinion of the Examiners this was not regarded as the correct answer. It was decided not to penalise candidates for having learned this incorrect fact, but Centres are reminded that teachers are responsible for checking that factual information contained within any text is accurate.

(b) (i) and (ii) Nearly every candidate wrote the correct figures for this question, but a significant number lost one mark for not indicating units in their responses.

(c) This section of the question produced a wide variety of responses. Candidates from some Centres had difficulty in answering it at all, whilst other easily scored the maximum number of marks available. Some candidates did not relate the question to the previous graph and simply described the passage of an impulse across a synapse, or described the local currents set up in the propagation of an impulse. There was some confusion between the functions of sodium and potassium channels and the sodium-potassium pump and if candidates wrote about sodium and potassium without indicating that these were in *ionic* form, marks were not awarded.

(d) (i) Few candidates scored more than one mark on this section of the question. Most could describe the stem cells as undifferentiated and a significant number also wrote that there were pluripotent, but very few referred to their ability to repeatedly divide by mitosis or their large nuclear to cytoplasmic ratio. Many candidates attempted to answer section (ii) in this section.

(ii) Virtually all candidates scored a mark for correctly stating a source of stem cells, although those that suggested 'zygote' or 'baby' were not credited. Few scored full marks for describing aspects of culturing stem cells, but a significant number of candidates did know that specific growth factors would need to be added to trigger dopamine-secreting neurone differentiation.

Q.5 This question tended to be the lowest scoring of the paper for the majority of candidates, with few candidates seemingly at ease describing the role of reduced NAD in anaerobic respiration, or relating the structure of an enzyme's active site with its function.

(a) Very few candidates scored more than one mark for this part of the question. Most simply defined aerobic *respiration* rather than aerobic *exercise*.

(b) Many candidates scored well on this section, accessing marks such as 'increased heart rate' and the roles of adrenaline and nitrous oxide. Descriptions of vasodilation / constriction must refer to *arterioles* (the Examiners continue to read about 'capillaries moving to the surface of

the skin', a common error seen at GCSE level) and many candidates wrote at length about changes relating to breathing rather than to the cardiovascular system. Some answers incorrectly focussed entirely on *long-term changes* to the CV system.

(c) (i) The majority of candidates scored the mark for stating that the pathway shown was that of glycolysis, although there were some imaginative spellings!

(ii) This was a very easy calculation and most candidates gained the mark. A few wrote the value in kJ for the complete aerobic respiration of a molecule of glucose.

(d) Few candidates scored well on this section. Vague language was a significant problem; with examiners rejecting statements such as 'the active site and its substrates have the *same* shape'. Many candidates were keen to mention the lock and key hypothesis, when it was induced fit that was required here and a significant number did not refer to the role of the ATP molecule at all.

(e) This section of the question proved problematic for the majority of students. There were a large number of very muddled answers and many simply described oxidative phosphorylation, seemingly unaware of the phrase 'absence of oxygen' in the question stem. Reference to the role of lactase dehydrogenase was rarely seen.

Q.6 This final question appeared to cause more problems for the majority of candidates than was expected given the straightforward nature of the questions asked, possibly due to the fact that it contained a small amount of plant biology. As the specification includes all the criteria for a biology specification, it must contain some plant material. However, this is approached in a way which is very human orientated.

(a) The majority of candidates could recognise photosynthesis and respiration from the diagram of the carbon cycle. Common errors saw these being written the wrong way around for X and Y, or Y being referred to as *excretion*. A small, but significant number of candidates merely described what was going on rather than naming specific processes, i.e. 'carbon is being released'

(b) Nearly all candidates scored one mark for realising that fewer trees meant less photosynthesis, so less carbon dioxide being removed from the atmosphere. Very few scored the second available mark for referring to burning or carbon sinks.
Common errors included candidates referring to *respiration* removing carbon dioxide, or responses that failed to mention the word photosynthesis in the explanation, e.g. 'trees remove carbon dioxide from the air, so if more are cut down there will be less carbon dioxide removed'.

(c) Again, very few candidates accessed the maximum number of marks on this section. A few candidates earned credit for stating that 'leaf litter

decomposes', but the role of bacteria and fungi was rarely mentioned and many answers were too vague to be awarded marks. A significant number of candidates seemed to think that the soil and leaf litter would form fossil fuels, releasing carbon dioxide when burned.

(d) The Examiners were surprised at the number of candidates who scored poorly on this section, not least because this topic is so much in the news. Those who did earn marks usually did so for describing the effect of global warming on ice caps, increasing sea levels and flooding low-lying land. Many candidates tried to describe the greenhouse effect, but did so without specific mention of the types of radiation involved and so failed to earn credit. Vague references to the 'earth heating up' were not credited, nor were statements such as 'animals and plants will become extinct' unless they were qualified with some explanation. Few candidates made mention of potential changes to agriculture, or altered weather patterns.

2867 Genetics, Homeostasis and Ageing

General Comments

There were only two candidates who attempted this paper in the January session. This report is therefore a brief general report on the paper, rather than on candidate performance, as the candidates would otherwise be easy to identify.

Each question on the paper provided opportunities for candidates with a wide range of ability to score some marks. All papers are set in a way which allows an E grade candidate to score 40% of the marks whilst an A grade candidate should be able to achieve 80% of the marks.

This is a demanding paper. It requires a thorough knowledge of the specification as half of the 120 marks are synoptic, but with each question is based on the content for module 2867. There is no set list of synoptic topics but certain areas of the specification lend themselves to synoptic questions, for example, transport mechanisms and enzymes from 2856, DNA, nutrition and natural selection from 2857 and the nervous system from 2866.

Teaching tip

Note the recommended prior knowledge in the introduction to each A2 Module.
Links with AS and A2 can be made whilst teaching the content for 2866 and 2867.

Students could be asked to brainstorm on an A2 topic e.g. temperature control, to construct a mind map on the board which represented all topics which could be applied to it. Topics could then be allocated to each student and they could then generate questions on it plus mark schemes, as a homework exercise.

Candidates should take note of the mark allocation and the number of lines given to answer the question. These should indicate the length of answer required, e.g. a three mark question is usually given five or six lines within which the answer should be given. It is always advisable to aim at one more fact than the mark allocation indicates e.g. in this case four. The exception is if the number of facts required is given as in question 7 (a) (i) which asks for **two** investigations. In this case the first two answers only will be marked.

Examiners are always disappointed to come across white space where a question has not been attempted. If a candidate has at least attempted an answer, a mark may be found, even if most of the answer is incorrect.

Teachers are reminded that whilst the OCR approved textbooks for the Human Biology course are excellent in every way, they are not the specification. All topics on the specification for this module are at full A Level standard and the Examiners are particularly pleased to see answers which show excellent detail and understanding of the topic.

Comments on Individual Questions

Q.1 This question generally scored well and was an encouraging first question.

(a) (i) The answers to this question were not difficult, but 'thinner' without qualification was not accepted for A.

(ii) This section partly accessed the synoptic work on the nervous system and did not produce sufficiently detailed answers.

(iii) Again the differences in osteoporosis tested the understanding of the differences between osteoarthritis and osteoporosis.

(b) (i)Candidates are now well rehearsed in producing data quotes from the graph. However, these are frequently of little value unless they are comparative. There was however a number of accessible marks for describing the graph.

(ii)This question also yielded three marks but the Examiners had hoped to see some reference to parathormone. The word 'affected' rarely scores any marks on examination papers as e.g. this question requires information on **how** bone density is affected by oestrogen or the lack of it.

Q.2 Candidates did not perform as well on this question (Specification reference 5.4.2.4) as the Examiners had hoped.

(a) The Examiners would have been pleased to see answers which indicated a sound understanding of the importance of the glomeruli in not only producing the glomerular filtrate, but also in retaining some materials and cells in the blood.

(b) It was thought that this question would produce two relatively easy marks but this was not the case.

(c) Providing that candidates do not answer ethical questions **with** a question, such questions are usually answered well.

(d) This was a straightforward question which required a thorough understanding of the method of haemodialysis. On the whole, answers lacked detail on how haemodialysis actually works.

Q.3 This question contained both recall questions on the eye and synoptic material on the action of enzymes.

(a) (i) The Examiners would prefer candidates to use the term diabetes mellitus rather than simply 'diabetes'.

(ii) A simple reference to the greater thickness in the middle would have scored one mark but the Examiners had hoped that the distance from the

blood supply might also feature in the answer.

(iii) The technique for removing a cataract is simply described in the textbook approved for this specification :

Human Biology for A2 Mary Jones, Geoff Jones. CUP 2005 ISBN 0-521-54891-8

(iv) This section tested the understanding of the cataract operation which does not provide the patient with a lens which will accommodate. Glasses are therefore frequently required.

(b) (i) and (ii) The candidates coped well with the data on telomeres.

(iii) Candidates did not recognise that this section was testing the understanding of enzyme action with reference to this particular case. The mark scheme therefore credited references to the specificity of the enzyme, and the complementary nature of the free nucleotides and those on the DNA, to the active site, enabling the formation of an enzyme substrate complex.

Q.4 This question did not score as well as the Examiners had hoped.

(a) An understanding of the principles of scientific method is important and the question on variables had a very generous mark scheme.

(b) This section carried three marks so more detail was required than the observation that respiration released thermal energy, for example, an awareness that the release of thermal energy is during ATP production and that it is transported in the blood throughout the body to compensate for heat loss in a cold climate.

(c) This section required an understanding of natural selection and the marking points covered the survival advantage of this mutation which allows it to be passed on.

(d) The transfer of energy through the food chain is covered in Module 2866, learning outcome 5.3.4.1 (i). Candidates found this section difficult.

(e) This question was a straightforward mark-yielding question from the 2867 specification.

Q.5 The genetics in section (a) of this question was completed without difficulty. However, the subsequent synoptic material was not as accessible to the candidates.

(a) The candidates had no difficulty with the genetics in this question and 'error carried forward' marks were available if the key did not follow the usual cionvention.

(b) This question used synoptic material from 2856 5.1.1.3. Marks available

covered the role of an ice pack as a means of coagulating blood and therefore slowing its flow down.

(c) (i) and (ii) The answers to this section were not detailed enough to score five marks. Learning outcome 5.1.2.2 (g) from Module 2856 is a help in this respect.

(iii) The advantages of genetically engineered Factor VIII presented little difficulty.

Q.6 Many of the marks on this question were graded at the upper end of the range.

(a) This question required candidates to explain the Hardy-Weinberg principle. The question was graded at the upper end as this is not an easy concept for candidates to understand.

(b) This potentially difficult calculation presented no difficulty to the candidates. Where complex calculations such as Hardy-Weinberg and statistical calculations are tested, formulae are routinely given.

(c) Most candidates are familiar with the selective advantage of sickle cell trait where malaria is endemic, but many fail to point out that the normal homozygotes and those with sickle cell disease more frequently die of malaria.

(d) It was hoped that candidates would realise that the Hardy-Weinberg equation assumes that there is no selection. Therefore if the allele frequency changes there must be a reason.

Teaching tip

Use beads to illustrate the effects on allele frequency of genetic crosses. The principles of the Hardy-Weinberg equation can then be introduced. This may be followed up by using the beads to illustrate the effects of selection on the frequency of the alleles. This can then be substituted in the equation.

(e) (i) and (ii) Candidates coped well with the mechanism of the substitution but were less familiar with how the mutation caused sickle cell **trait**. The mark scheme allowed for differences in the R groups and therefore the tertiary structure of the haemoglobin molecule as well as the fact that normal haemoglobin and therefore normal cells would also be produced in the heterozygote.

Q.7 It was hoped that this would be a fairly simple question to finish the paper with, as it was appreciated that after two hours candidates may be tired.

(a) (i) The tests for blood glucose are clearly described in the approved textbook and should have been easy marks.

(ii) There is a lot of advice given to improve blood glucose levels including advice on diet, body mass, exercise and medication. It is unlikely that more than 1 mark is given for each category so e.g. two examples of diet will only score one mark.

(b) Fig. 7.1 was intended to help the candidates but did not appear to have been used.
(i) The receptor for insulin was clearly illustrated and named in the key as a membrane receptor. It also had a complementary shape to insulin and therefore reasonably illustrated a protein.

(ii) Similarly, the sequence of events was clearly illustrated on the Figure and simply needed describing.

(c) This question tested the synoptic material from module 2856 5.1.2.4 (a). Answers did not include enough information to score full marks.

Advanced GCE Human Biology 3886/7886
January 2006 Assessment Session

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	Number of candidates
2856.	Raw	60	47	40	34	28	22	0	1446
	UMS	90	72	63	54	45	36	0	
2857	Raw	60	48	42	36	30	25	0	288
	UMS	90	72	63	54	45	36	0	
2858B	Raw	120	96	84	72	61	50	0	90
	UMS	120	96	84	72	60	48	0	
2866	Raw	90	70	62	54	46	38	0	565
	UMS	90	72	63	54	45	36	0	
2867	Raw	120	84	74	64	54	45	0	3
	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	4.5	18.2	27.3	45.5	90.9	100.0	22
7886	0.0	0.0	0.0	100.0	100.0	100.0	1

For a description of how UMS marks are calculated see;
www.ocr.org.uk/OCR/WebSite/docroot/understand/ums.jsp

Statistics are correct at the time of publication

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