

# **Human Biology**

Advanced GCE **A2 7886**

Advanced Subsidiary GCE **AS 3886**

## **Combined Mark Schemes And Report on the Units**

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**June 2005**

**3886/7886/MS/R/05**

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PO Box 5050  
Annersley  
NOTTINGHAM  
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Telephone: 0870 870 6622  
Facsimile: 0870 870 6621  
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**Advanced Subsidiary GCE Human Biology (3886)**

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**Advanced GCE Human Biology (7886)**  
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**Mark Scheme 2856  
June 2005**

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 <u>      </u> = (underlining) key words which <b>must</b> be used to gain credit ecf = error carried forward AW = alternative wording A = accept ora = or reverse argument
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Question	Expected Answers	Marks
1 (a)	A - phagocyte / neutrophil / eosinophil / leucocyte / white blood cell ; B - red blood cell / RBC / erythrocyte ; <b>R</b> white blood cell	<b>2</b>
(b)	a group of <u>similar</u> cells ; carrying out a particular function ; examples of cells ;	<b>2 max</b>
(c)	wear gloves / avoid contamination with blood ; drop blood onto microscope slide ; dilute ; touch with coverslip, and lower to avoid bubbles / smear with a second slide at 45° ; capillary action spreads blood ; dry in air ; add stain ; <b>R</b> dye flood ; e.g. eosin / methylene blue / Leishmann's / Wright's ; and water ; rock to mix / spread / smear ; leave ten minutes and wash off extra stain ; blot gently with filter paper ; AVP ; e.g. fix with methanol	<b>5 max</b>

**[Total: 9]**

Question	Expected Answers	Marks
2 (a)	<i>in correct context</i> R- group shown / e.g. of ; amino group ; carboxyl group shown ;	2 max
(b) (i)	amino / amine / NH <sub>2</sub> ; carboxyl / COOH ; R group ;	2 max
(ii)	peptide ;	1
(iii)	hydrolysis ; <b>R</b> catabolic	1
(c)	<i>A in context of any protein</i> <i>R only one side of argument</i>  ref to folds / twists ; ref to correct bonds ; e.g. H bonds in secondary, H, ionic and disulphide in tertiary secondary is alpha helix, tertiary is globular ;	2 max

**[Total: 8]**

Question	Expected Answers	Marks
3 (a)	absent ; present ; present ; absent ;	4
(b)	from left to right ;	1
(c)	<i>at arterial end</i>  high hydrostatic in capillary ; high water potential in capillary ; low hydrostatic in tissue fluid ; water flows out ;  plasma proteins remain in capillary / AW ;  <i>at venous end</i>  loss of hydrostatic pressure ; low water potential in capillary ; proteins lower water potential ; water potential gradient higher in tissue fluid ; water moves in ;  by osmosis ; down gradient ; AVP ; e.g. use of figs	4 max

[Total: 9]



Question	Expected Answers	Marks
4 (a)	(i) D - right atrium ; E - right ventricle ; F - left ventricle ;	3
	(ii) provides more, force / pressure ; to push blood around the body / larger distance (qualified) ; as opposed to lungs (right ventricle) ; or right ventricle (right atrium) ;  <i>ignore names , accept letters</i>	3 max
(b)	<i>mark (i) and (ii) together</i>	
	(i) <u>spread</u> of, electrical activity / action potentials ; from SAN ; depolarisation over atria ; electrical activity before atrial systole ;	
	(ii) electrical activity / action potentials / impulse reaches AVN ; delays impulse ; spreads through, the septum / Purkyne fibres / bundle of His ; ref to depolarisation of ventricles ;  AVP ; e.g. AVN transfers impulse to Purkyne fibres / takes impulse to apex	4 max
(c)	skeletal muscles produce electrical activity ; heart rate changes ; which may be picked up by ECG and distorted ; check resting ECG as comparison / AW ;	2 max
(d)	coronary heart disease / valve defects / holes in the heart ; don't affect electrical activity ; AVP ;	2 max
		<b>[Total: 14]</b>

Question	Expected Answers	Marks
5 (a)	damages, endothelium / <u>artery</u> wall ; correct ref to coronary artery ; phagocytes invade artery wall ; cholesterol deposited ; plaque forms ; atherosclerosis / atheromas ; narrows coronary artery ;  AVP ; e.g. this further increases blood pressure deprives heart muscle of, oxygen / glucose	3 max
(b)	1 cuff placed around (upper) arm / AW ; 2 cuff inflated ; 3 stops blood flow in (brachial) <u>artery</u> ; 4 stethoscope placed over artery ; 5 cuff deflated ; 6 systolic pressure is pressure heard as a soft tapping sound ; 7 diastolic pressure is measured as sound disappears ; 8 on manometer attached to cuff ; 9 figures expressed as mmHg ; 10 first figure systolic pressure ; 11 second is diastolic ; 12 e.g. 120/80 (mmHg) ; 13 ref to automatic machines ; 14 ref microphones ; 15 AVP ; e.g. social and ethical points / sitting down / looking away etc / Korotkov sounds	6 max
	<b>QWC - quality of spelling, punctuation and grammar ;</b>  <i>no more than three different spelling errors</i>	1
		<b>[Total: 10]</b>

Question	Expected Answers	Marks
6 (a)	<p>108 – 96 / 108 x 100 ; 11% ;</p> <p><i>correct answer only ; ; ecf correct method wrong figures 1 max failure to round 1 max</i></p>	2 max
(b) (i)	<p><i>men</i> 48 % less dying from lung cancer between 1974-2000 ; decrease ; steeper decline between 1990 and 1994 ; change in rate of decrease ;</p> <p><i>women</i> gradual increase ; until 1996 ; then levels off ;</p> <p>change in number of deaths in combined men and women ; AVP ;</p> <p>figs to support ; correct use of units ;</p>	4 max
(ii)	<p><i>support</i> steady decrease in % smokers in men followed by similar pattern in cancer cases ; cancer takes 20+ years to develop / AW ;</p> <p><i>does not support</i> no correlation for women / AW ; AVP ; e.g. some other factor must be involved decrease in female smokers followed by slow increase in cancer cases ;</p> <p>figures to support ; ;</p>	3 max
(c)	<p>CHD ; strokes ; AVP ; e.g. asthma</p>	1 max
		[Total: 10]

**PAPER TOTAL 60**



**Mark Scheme 2857**  
**June 2005**

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
	<u>      </u>	=	(underlining) key words which <b>must</b> be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
A	=	accept	
ora	=	or reverse argument	

Question	Expected Answers	Marks
1 (a)	male ; (one X and) one Y chromosome present / females have two X chromosomes ;	2
(b)	visible on karyotype / AW ; ora usually large / gross abnormalities ; ora example, ref to changes in number ; gene abnormalities often metabolic / biochemical ; may not show for some time ; AVP ; e.g. time-consuming qualified	3 max

[Total: 5]

Question	Expected Answers	Marks
2 (a) (i)	UV, radiation / light ; ionising radiation / X-rays / gamma rays ; contraceptive pill / HRT ; retrovirus ; DNA virus <i>or</i> named example (e.g. papilloma or Epstein-Barr) ; radon gas ; chemical mutagen <i>or</i> named example (e.g. benzene, soot, mineral oils, inorganic arsenic compounds, mustard gas, alcohol, asbestos products) ; AVP ; e.g. radiation / signals from phone masts	R hereditary / genetic predisposition  R chemical  <b>2 max</b>
(ii)	proto-oncogenes, control cell division ; proto-oncogenes become oncogenes ; caused by mutation ; (abnormal) stimulation of cell cycle / increase in rate of mitosis ; cell divides out of control / AW ; AVP ; e.g. apoptosis	<b>3 max</b>
(b)	risk of death from lung cancer increases with increasing number of cigarettes smoked ; non-smokers rarely die from lung cancer ; <i>ora</i> ex-smokers largely reduce their chances of dying from lung cancer ; use of figs ;	<i>2 max for description</i>
	increased tar / carcinogens, lead to cancer ; other things cause lung cancer ; some damage is reversible ; <i>ora</i>  AVP ;	<b>3 max</b>

continued

**Question 2 Expected Answers**  
cont'd

(c) *max 3 marks on any one form of treatment*

- 1 **surgery** / operation ;
- 2 small area, one **lobe** / whole lung may be removed ; **A lobectomy**
- 3 **radiotherapy** ;
- 4 beam of **radiation** / X-rays / gamma rays, directed onto cancer cells ;
- 5 may be used to prevent, spread of cancer / **metastasis**, in patients not well enough  
for surgery / after surgery ;
- 6 **chemotherapy** ;
- 7 named drug / **cytotoxic** drug ;
- 8 targets rapidly dividing cells / stops cell division ;
- 9 (treatment consists of) several cycles, over a number of weeks ;
- 10 with rest weeks in between to allow for recovery ;
- 11 to shrink, cancer / tumour ;
- 12 to control symptoms of the cancer ;
- 13 **immunotherapy** ;
- 14 still largely experimental ;
- 15 aims to manipulate **immune** system into fighting cancer cells more aggressively ;
- 16 use of **monoclonal antibodies** ;
- 17 use of, **interferon** / **cytokine** ;
- 18 **complementary therapies** ;
- 19 used to support conventional treatment ;
- 20 named e.g. ; (massage, **reflexology**, **guided imagery**, **progressive muscle  
relaxation**, **hypnotherapy**, **acupuncture**)  
immunotherapy **6 max**
- 21 AVP ; e.g. kills cancer cells in context of radiotherapy / chemotherapy /

**QWC – quality of use and organisation of scientific terms ;**

*award mark for at least three of the terms marked in bold*

**1**

**[Total: 15]**



Question	Expected Answers	Marks
3 (a)	(i) E – deoxyribose / pentose / 5C sugar ; F – phosphate (group) / $\text{PO}_4^{(3-)}$ / Pi ;	R sugar / ribose R phosphorus / P <b>2</b>
	(ii) hydrogen (bonds) / H ;	<b>1</b>
(b)	36% A + T, $100 - 36 = 64 / 2$ ; 32 ; <i>ecf correct method wrong figs ; correct answer only ; ;</i>	<b>2 max</b>
(c)	(i) X ;	<b>1</b>
	(ii) one old / original <u>strand</u> ; one new <u>strand</u> ; so double helix is conserved / AW ; from one generation to the next ; new molecule identical to old molecule ;	<b>2 max</b>
	(iii) capable of carrying coded information ; capable of accurate replication ; each base will only pair with its complementary partner ; double helix structure can easily give rise to two new strands during replication ; can be packaged into small structures (chromosomes) ; degenerate code decreases chance of mutations having negative effects ; stable molecule ; weak / easily broken H bonds ; repairable if one strand damaged ;	<b>3 max</b>

[Total: 11]

Question	Expected Answers	Marks
4 (a)	(i) disease caused by <u>pathogen</u> ; has a causative organism / AW ; can be transmitted from one person to another ;	2 max
	(ii) infectious diseases are (major) killers worldwide / AW ; no effective treatments previously available ; idea of antibiotics being very effective / AW ; credit ref to named example of disease, now controlled by antibiotics ; AVP ;	2 max
	(iii) bacteria / named ; fungi / named ;	2 max
(b)	course not completed ; antibiotics incorrectly prescribed / use of broad spectrum antibiotics / no prior selection of specific antibiotic ; <u>natural selection</u> / have selective advantage ; the antibiotic is the selective agent / AW ; pass on resistance genes to other bacteria ; idea of divide, (to form clone) / (naturally) resistant bacteria survive / <i>ora</i> ; can transfer resistance genes to other bacterial species / horizontal transmission / AW ; further mutations may enhance survival ability ; bacteria may acquire several resistance genes / become resistant to more than one antibiotic ; AVP ; e.g. resistant bacteria spread to other humans original resistance result of mutation	5 max
		<b>[Total: 11]</b>

Question	Expected Answers	Marks
5 (a)	used to check if TB is present or has been present / TB antibodies ; in absence of past or present TB, no reaction shows ; vaccine given ; if TB is present / has been, site will swell / redden / AW ; no vaccine is given ; further tests ;	3 max
(b)	chest X-ray (if positive skin test) ; sputum sample ; culture bacteria ;	2 max
(c)	must (coordinate) isolation ; organise vaccination / collect stock of antibiotics ; organize X rays ; to prevent spread ; credit named personnel ; e.g. (district) health authority / local hospitals / local GPs / WHO education ; contact tracing / AW ; AVP ; e.g. further details of any above / social / ethical issues	2 max
		<b>[Total: 7]</b>

Question	Expected Answers	Marks
6 (a) (i)	increases from 8-9 ; more rapid increase from 9-13 ; slower increase from 13-16 ; levels off after 16 / 17 ; use of figs from both axes ;	3 max
(ii)	hormones released at puberty ; cause rapid increase ; baby's (head) needs to pass through pelvis (during childbirth) ; levels off because adult size attained ; AVP ; e.g. hormonal balance / fusion of pubic symphysis	2 max
(b)	ref to lack of Hb and oxygen / energy for growth ; iron / blood (replacement), during menstruation ; prevents (iron deficiency) anaemia ;	1 max
(c) (i)	prevent neural tube defects / AW ; prevent spina bifida ;	1 max
(ii)	can be offered / given vaccine if necessary ; prevent spread of german measles / prevent infection, during pregnancy ; AVP ; e.g. advice can be given  (risk of) blindness ; deafness ; heart defects ; nervous system damage ; mental retardation ; miscarriage ;	4 max
	<i>max 3 on risks to foetus</i>	
		[Total: 11]

**PAPER TOTAL 60**

**Mark Scheme 2858/01  
June 2005**

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 <u>      </u> = (underlining) key words which <b>must</b> be used to gain credit ecf = error carried forward AW = alternative wording A = accept ora = or reverse argument
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Question	Expected Answers	Marks
1 (a)	(coronary) bypass ; heart transplant ; (repair of) hole in the heart ; AVP ; e.g. angioplasty	2 max
(b)	(valves) prevent backflow / AW ; from ventricles to atria ; (pressure) pushes them shut / described ; ref to valve tendons ; ref <u>lower</u> pressure in atria (compared to ventricle) / ora ;	2 max
(c) (i)	arrow going from left ventricle into left atrium ;	1
(ii)	(using a ) stethoscope ; (to detect) a murmur/change in normal heart sound / described / not lubb dup / AW ; echocardiogram / described ; AVP ; e.g. further detail of echocardiogram, ref to ultrasound, Doppler scan R ref to ECG	2 max
(iii)	reduced / less (than normal) / AW ;	1
(d) (i)	P ;	1
(ii)	Q ;	1
(e) (i)	(provide a) large surface area ;	1
(ii)	short distance (for gases to diffuse) / idea ;	1
(iii)	brings oxygen / removes carbon dioxide ; maintains (diffusion / concentration) gradient ;	1 max

continued

**Question 1 Expected Answers**  
cont'd

- (f) (i) sterile ;  
ref monitors / maintains, a suitable / body, temperature ;  
ref monitors / maintains, pH ;  
ref reduces blood clotting / described ;  
ref maintenance of blood pressure ;  
partially / differentially, permeable membrane ;  
ref to air bubbles ;  
maintains blood flow, qualified ;  
AVP ; e.g. maintains flow of, nutrients / oxygen, to tissues  
addition of drugs **2 max**
- (ii) removes (blood) clots ;  
removes debris from machine / AW ;  
AVP ; **1 max**
- (g) ref to protein, pore / channel ;  
spans the (phospholipid) bilayer / idea *or* transmembrane / intrinsic protein ;  
**A** labelled diagram.  
(lined with) hydrophilic, R-groups / amino acids ;  
phospholipid bilayer is hydrophobic / (ions) cannot cross (phospholipids) bilayer ;  
ref, Na / K, pump ;  
AVP ; e.g. ref shape change  
active transport / ATP ref **3 max**
- (h) acts as an antigen ;  
triggers immune response / activates immune response ;  
recognised as foreign / AW ;  
by, antigen presenting cell / APC / macrophage ;  
triggers (T), lymphocyte / cell, production ;  
inflammation / damage ;  
destroys foreign cells / AW ;  
AVP ; e.g. ref to glycoprotein / glycocalyx / HLA complex  
ref to phagocyte action  
ref to specificity / clonal selection **4 max**

**[Total: 23]**

Question	Expected Answers	Marks
2 (a)	threonine, glycine, glutamine ; ;	2 only correct allow 1 mark. 2 max
(b)	<p>1 change in a (DNA) base ;</p> <p>2 detail of ( DNA) change ;</p> <p>3 (different) <u>triplet</u> code / described ;</p> <p>4 (leading to) a different / AW, (mRNA)codon / correct reference to transcription ;</p> <p>5 (different) tRNA ;</p> <p>6 (different) anticodon ;</p> <p>7 different <u>primary structure</u> ;</p> <p>8 different R group ;</p> <p>9 ref to, <u>tertiary</u> / <u>quaternary</u>, structure ;</p> <p>10 <u>active site</u>, changes shape ;</p> <p>11 enzyme / PAH, does not, fit / recognise, substrate / phenylalanine ;</p> <p>12 no enzyme-substrate complex forms ;</p> <p>13 AVP ; e.g. ref to chromosome 12, phenylalanine / tyrosine differences</p> <p>14 AVP ;</p>	7 max
(c)	<p>vitamin A / D / folic acid / another named vitamin ; <b>R</b> vitamin B on its own correct role ;</p> <p>calcium / iron / phosphorus / another named mineral ;</p> <p>correct role ;</p>	4
(d)	<p>(transfer of) <u>antibodies</u> / ref to <u>passive</u> immunity ;</p> <p>ref to colostrum ;</p> <p>ref to maternal bonding ;</p>	1 max
(e) (i)	<p>growth rates faster in boys ;</p> <p>birth weight higher in boys ;</p> <p>any correct comparative statement ;</p>	1 max
(ii)	<p>109 ;</p> <p>18 ;</p>	2
(f)	<p><i>look for reverse argument</i></p> <p>brain development / mass (almost) complete / AW ;</p> <p>relevant data quote ; e.g. little change after 5 years</p> <p>less risk of brain damage ;</p> <p>AVP ; e.g. safety margin to allow for slower development</p> <p>similar in both sexes</p>	3 max
(g)	<p>(prevalence) – not a mark</p> <p>(figure represents) number of existing cases / AW ;</p> <p>within a (stated) population / per 300 000 / fig ref ;</p> <p>incidence is number of <u>new</u> cases ;</p>	2 max

[Total: 22]

**PAPER TOTAL 45**



**Mark Scheme 2866  
June 2005**

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 <b>must</b> be used to gain credit ecf = error carried forward AW = alternative wording A = accept R = reject ora = or reverse argument
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Question	Expected Answers	Marks
1 (a) (i)	A ciliary body / muscle / suspensory ligament ; B vitreous humour / AW ;	2
(ii)	contains blood vessels / named ; supply retina with, oxygen / glucose ; contains melanin / pigmented ; to reduce (internal) reflection / AW ; <b>A</b> absorb light qualified	2 max
(b) (i)	bleeding, behind / on, the retina ; ruptures the <u>capillaries</u> ; destroys / damages, sensory cells / named cells <i>or</i> loss of / blurred, vision / AW ; AVP ;	2 max
(ii)	vitamin A is, precursor of / AW, retinal ; <b>A</b> retinene no, rhodopsin <i>or</i> no, visual / light sensitive, pigment / AW ; would not be able to see in low light / night blindness ; AVP ; e.g. ref to wavelengths	2 max
(c)	iris contains smooth muscle ; antagonistic ; when, circular muscle contracted / radial muscle relaxed ; constricts pupil / pupil diameter decreased / AW ; <i>only if matches point above</i> reflex (response), to light ;	3 max

[Total: 11]

Question	Expected Answers	Marks
2 (a)	(i) A medulla (oblongata) ; B cerebellum ; C cerebral, hemispheres / cortex ; <b>A cerebrum</b>	<b>3</b>
	(ii) (CT scan) uses X-rays ; different structures absorb X-rays to different degrees / AW ; several beams from different angles ; computer puts the X-ray pictures together ; may be given injection of (X-ray opaque) dye ; to show blood vessels ;	3 max
	detailed picture / detail e.g. slices / colours ; shows structural damage / e.g. of structural damage ; shows tumours / blood clots / loss of brain cells ; shows haemorrhage / stroke damage ; AVP ; e.g. scanners (may) produce 3D picture non-invasive compare with normal brain	3 max
		<b>4 max</b>
(b)	diamorphine / heroin, is similar in structure to / mimics, enkephalins / endorphins ; neurotransmitters ; modify the <u>perception</u> of pain (from all parts of the body) ; (diamorphine / heroin) combines with / AW, receptors ; enkephalin / endorphin / opiate, receptors ; prevents sensory neurone sending impulse to pain centre / AW ; AVP ; e.g. effect lasts longer than natural neurotransmitter inhibits pain receptors mimics endorphins	<b>3 max</b>

continued

Question 2  
cont'd

- (c) *psychological*  
 (compulsion) to use, the drug / alcohol, for favourable effect / euphoria ;  
 cannot cope with stress of being without drug ;  
 escape from reality ;  
 reduce, stress / anxiety / inhibitions ; **A** anxiolytic  
 emotional attachment to the drug / feels the need / used as prop ;  
 changes in, behaviour / lifestyle, so life revolves around drug taking / e.g. ;  
 enjoys these changes ;  
 only mild discomfort / no serious physical effects on withdrawal ;  
 AVP ; e.g. specific example for alcohol

4 max

*physical*

- idea that body does not operate properly without the drug / AW ;  
 drug necessary for normal metabolism / AW / e.g. ;  
 continued use necessary to prevent withdrawal symptoms ;  
  
 named withdrawal symptom from heroin ;  
 e.g. anxiety / craving / perspiration / gooseflesh /  
 shivering / pupil dilatation / muscle tremors /  
 insomnia / restlessness / vomiting / diarrhoea /  
 dehydration / weight loss / increase in BP / heart rate /  
 respiratory rate / temperature / hypersensitive to pain  
  
 dependence on heroin develops very quickly ;  
  
 named withdrawal symptom from alcohol ;  
 e.g. rebound excitability / morning shakes /  
 tremors / hallucinations / agitation / confusion /  
 delirium tremens (DT's)  
  
 physical dependence preceded by psychological dependence in alcohol  
 addiction ;  
 AVP ; e.g. use of methadone for heroin

- both cause social problems / e.g. ;  
 both may develop tolerance ;  
 detail ;

8 max

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

*no more than three different spelling errors*

1

[Total: 19]

Question	Expected Answers	Marks
3 (a)	<p>mutation ;  gene / chromosomal ;  inherited / passed on from parents / AW ;  AVP ; e.g. not caused by the environment / AW  e.g. of another genetic disease which causes infertility</p>	2 max
(b) (i)	<p>only one X / XO / only 45 chromosomes ;  involves, sex chromosome / pair 23 ;  non-disjunction ;  in gametes ;  gamete has no X ;  fuses with, normal / X carrying, gamete ;</p>	2 max
(b) (ii)	<p>sterile / infertile ;  ovaries / sex organs, may not develop / be immature ; <b>R</b> testes  no, gametes / germ cells ;  no oestrogen ;  no secondary sexual characteristics ;</p> <p><i>OR</i></p> <p>some / half, female gametes, will not have, an X / a sex, chromosome ;  may die ;  if fertilised by normal male, offspring will have Turner's syndrome / one X ;  or YO ;  YO not viable ;  Y carries few genes ;  X carries, blood clotting gene / other e.g. ;</p>	3 max
(c) (i)	<p>antibiotic ;  because it is a bacterial infection ;</p>	2
(c) (ii)	<p>men must also receive treatment ;  to prevent, reinfecting / infecting other women / AW ;</p> <p><b>R</b> refs to men carrying bacterium</p>	1 max

continued

**Question 3**  
cont'd

- (iii) *max two for description (points 1 to 3)*
- 1 (the number of cases) is increasing ;
  - 2 higher rate of increase in women / more women diagnosed ;  
    **R** more develop chlamydia
  - 3 figs in support, both axes ; 2 max
  - 4 idea of more aware of the symptoms so more diagnoses ;
  - 5 one man may infect many women ;
  - 6 (transmitted by) unprotected sex ;
  - 7 (woman) may have many sexual partners / idea of promiscuity ;
  - 8 data may be representative / AW ;
  - 9 may be no symptoms in male / more obvious in female / AW ;
  - 10 men do not seek treatment / women seek treatment ;
  - 11 frequently misdiagnosed ;
  - 12 many, men / women, not treated ;
  - 13 no routine screening programme ;
  - 14 AVP ; increase in transmission **4 max**
- (iv) other STDs are likely to spread as fast ;  
may also be undetected ;  
AVP ; e.g. appropriate reference to gender of infected individual **2 max**
- (d) (i) disappointing for couple / AW ;  
not cost effective / high cost ;  
money could be spent on other medical procedures ;  
AVP ; ; e.g. fate of unused embryos **R** eggs **2 max**
- (ii) artificial insemination ;  
frozen embryo replacement ;  
ovulation induction ;  
GIFT ;  
ZIFT ;  
AVP ; e.g. cloning suitably qualified **2 max**

**[Total: 20]**

Question	Expected Answers	Marks
4 (a) (i)	A matrix ; B crista ; C ribosome ;	3
(ii)	$\frac{46 / 47 / 48 \times 1000 / 4.6 / 4.7 / 4.8 \times 10\ 000}{50\ 000}$ ;  0.92 / 0.94 / 0.96 ( $\mu\text{m}$ ) ; A 920 / 940 / 960 <u>nm</u>  <i>correct answer only ; ; ecf ; wrong measurement correct method max 1</i>	2
(b)	<i>D</i> inter-membrane space, (between two membranes) ; H <sup>+</sup> ions pumped into it / through ; inner membrane impermeable to H <sup>+</sup> ions ; allows for the build up of H <sup>+</sup> ions (in this area) ; to build up, a concentration / an electrochemical gradient ; to provide energy for ATP production / oxidative phosphorylation ; AVP ; e.g. 3 H <sup>+</sup> : 1 ATP ( <i>A for D or E</i> ) 3 max  <i>E</i> (channel in) the stalked particle ; allows for the H <sup>+</sup> ions to diffuse down the concentration gradient ; H <sup>+</sup> ions move through the channel ; causes, ATP synthetase / ATP synthase / ATPase ; to produce ATP from ADP + P <sub>i</sub> ; from, electrochemical / potential, energy ; AVP ; e.g. chemiosmosis, detail on the action of the enzyme 3 max	5 max
(c)	oxygen is the terminal, [H <sup>+</sup> ] / proton / electron, acceptor ; forms water ; from H <sup>+</sup> and e <sup>-</sup> ; $2[\text{H}] + 2\text{e}^- + \frac{1}{2} \text{O}_2 = \text{H}_2\text{O} / 4\text{H}^+ + 4\text{e}^- + \text{O}_2 = 2 \text{H}_2\text{O} ; ;$	2 max

[Total: 12]

Question	Expected Answers	Marks
5 (a) (i)	ring round adenine, ribose and proximal phosphate ;	1
(ii)	active transport ; muscle contraction / movement ; nerve conduction ; anabolic reactions / e.g. ; AVP ; ; any suitable e.g.	2 max
(iii)	1 chlorophyll absorbs light / photosynthesis ; 2 transfers energy from light energy into chemical energy 3 named form e.g. glucose ; 4 light / photons into ATP / electrons / NADPH <sub>2</sub> ; 5 ATP energy source for making CHO / plant tissue / AW ; 6 (indirectly) eaten by humans / ref to food chain / web ; 7 released as ATP during respiration ; 8 AVP ; e.g. correct ref to phases of photosynthesis	3 max
(b) (i)	$\frac{32 \times 30.6}{2880} \times 100$ ;  34 (%) ; <i>correct answer only ; ; ecf ; max 1</i>	2
(ii)	released as heat ; helps to increase body temperature ; <b>R</b> controls / maintains AVP ;	1 max

continued



**Question 5**  
cont'd

- (c) (i) 2 max for each method : method + effect

*mark the two highest scoring e.g.s if more than two given  
if wrong technique for method described, mark the technique*

(Rh)EPO / (recombinant) erythropoeitin ;  
increases red cell production ;  
increases O<sub>2</sub> transport ;  
increases endurance ;

OR

blood doping ;  
transfusing own red cells ;  
after blood volume has compensated / plasma removed ;  
increases O<sub>2</sub> transport ;

OR

creatine monohydrate ;  
increases muscle energy reserves ;  
high energy compound ;  
increases mental alertness ;

OR

oestrogen inhibitors / testosterone / (anabolic) steroids ;  
increase muscle mass / size / strength ;  
increase work rate / AW ;  
AVP ; increases aggression

**4 max**

- (ii) unfair on competitors / cheating / AW ;  
drugs have, unknown side effects / named side effect ;  
prescription only ;  
need specialist knowledge to prescribe safely ;  
may be from unsafe source / contaminated / AW ;  
AVP ; e.g. bringing, sport / countries, into disrepute

**3 max**

**[Total: 16]**

Question	Expected Answers	Marks
6 (a)	<p>1 mitosis ;</p> <p>2 in <b>germinal epithelial</b> cells / epithelium / germ cells ;</p> <p>3 <b>oogonia</b> produced ;</p> <p>4 grow ;</p> <p>5 form <u>primary oocyte</u> ;</p> <p>6 surrounded by cells / <b>primary follicle</b> ;</p> <p>7 before birth ;</p> <p>8 meiosis arrested in <b>prophase I</b>, (until) puberty / in foetus ;</p> <p>9 diploid / 2n ;</p> <p>10 meiosis I produces <u>secondary</u> oocyte ;</p> <p>11 haploid / n ;</p> <p>12 and first <b>polar body</b> ;</p> <p>13 contained within <b>Graafian</b> follicle ;</p> <p>14 released at ovulation / AW ;</p> <p>15 process / AW, stops until fertilisation / AW ;</p> <p>16 stops at metaphase II ;</p> <p>17 forms second polar body ;</p> <p>18 ref to hormones in correct context ; ; e.g. <b>GnRH</b> stimulates <b>FSH</b> from <b>anterior</b></p> <p>19 <b>pituitary</b>, FSH stimulates development of the follicle, oestrogen from follicle, inhibits FSH / <b>LH</b>, surge of FSH and LH causes ovulation.</p>	
20	<p>AVP ; <b>independent assortment</b> / crossing over / <b>chiasma</b>, in meiosis I</p> <p><b>QWC – clear, well organised, using specialist terms ;</b></p> <p><i>award mark for at least four of the terms marked in bold</i></p>	8 max
(b)	<p>halves chromosome number ;</p> <p>so that diploid number restored at fertilisation ;</p> <p>allows variation ;</p> <p>by crossing over ;</p> <p>independent / random, assortment ;</p> <p>passes complete set of DNA to offspring / AW ;</p>	3 max
		[Total: 12]

**PAPER TOTAL 90**

**Mark Scheme 2867**  
**June 2005**

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
	<u>      </u>	= (underlining) key words which <b>must</b> be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	A	= accept
R	= reject as wrong in context	
ora	= or reverse argument	

Question	Expected Answers	Marks
1 (a) (i)	CTAAC;	1
(ii)		1
	A without horizontal line if verticals correct	1
(iii)	complementary / matches active site of enzyme ; specific ; (strands) palindromic / symmetrical ; 4-6 base pairs long ;      A up to 8 sticky ends explained / ref to blunt ends / AW ;	2 max
(b)	the sequence of one strand determines sequence of the other / one strand complements the other / complementary base pairs between two strands ; purine binds to a pyrimidine ; A – T / C – G ; run in opposite direction to each other ; one, strand / deoxyribose / sugar, runs <u>5 to 3</u> , <u>one 3 to 5</u> ;	3 max
(c)	unspecialised / undifferentiated ; only need to, insert / introduce, gene into one cell / AW ; divides by mitosis / clones ; <u>pluripotent</u> ; will develop into any, tissue / cells, required ; e.g. of tissue / disease treated ; AVP ;      e.g. genes are switched on, cells differentiate, if own cells used no immune response	3 max

[Total: 10]

Question	Expected Answers	Marks
2 (a) (i)	sweating ; evaporation / latent heat of evaporation ; vasodilatation ; heat loss by, radiation / convection / conduction ; restores set point ; by, homeostasis / negative feedback ; AVP ; e.g. further explanation, behavioural changes related to exercise, hairs flatten, ref to skin receptors	2 max
(ii)	ref to e.g. of work / increase in oxygen / blood to muscles / muscle contraction ; respiratory rate increases ; <i>increase may be implied</i> increased, rate of chemical reactions / metabolic rate ; release of, thermal / heat, energy ; <b>A</b> exothermic during ATP production ; AVP ; sustained exercise uses aerobic respiration	2 max
(b) (i)	1 metabolic / chemical, reactions are heat sensitive ; <b>A</b> ref metabolism 2 malfunctioning ; 3 enzymes have an optimum temperature / AW ; 4 temperature effect on enzyme / protein e.g. denaturing / slowing ; 5 detail on temperature effect e.g. failure to form E-S complex ; 6 raised temperature may cause excessive water loss / AW ; 7 change, concentration of body fluids / electrolyte balance ; 8 may cause excessive, salt / NaCl / Na <sup>+</sup> Cl <sup>-</sup> , loss ; AVP ; e.g. may cause brain damage if too high, could be fatal, hyperthermia	3 max
(ii)	cannot maintain it any lower ; ref to balance between heat loss and heat production ; e.g. can't remove heat fast enough AVP ; <b>R</b> short term	1 max
(c) (i)	$\frac{68 - 60}{68} \times 100$ ; 12 (%) ; <i>correct answer only ; ; ecf ; 1 max 11.76 ; 1 max</i>	2
(ii)	as (mean) temperature increases (mean) body mass decreases / <i>ora</i> ; inversely proportional / negative correlation ; thin / low mass, have an increased <u>surface area to volume ratio</u> / <i>ora</i> ; greater dissipation / loss of heat / <i>ora</i> ; figs in support, comparative both axes ; AVP ; e.g. helps to maintain the set point, ref to insulating effect body fat	3 max

continued

**Question 2  
continued****(iii) A ora throughout for a hot climate**

advantage to maintain body temperature ;  
endothermic ;  
selective advantage / natural selection ;  
detail on evolution ; e.g. those adapted survived / ora  
survival of the fittest ;  
advantageous, genes / alleles, more likely to be passed on ;  
more energy for other activities / named ;  
less metabolic effort required / passive process / requires less energy ;

**2 max****(iv) nutrition / named e.g ;**

disease (control) ;  
stress / mental illness / named e.g ;  
AVP ; e.g. accident / named e.g., social reason qualified, exercise

**2 max****[Total: 17]**

Question	Expected Answers	Marks
3 (a) (i)	BP contraction of the left ventricle / efferent arteriole narrower ; WP ions / plasma proteins / named, decrease water potential (of plasma) ; CP pressure of glomerular filtrate pushes against basement membrane / AW ;	3
(ii)	$EFP = BP - (WP + CP)$ / $BP - WP - CP$ ; <b>A</b> word equation	1
(b) (i)	selective reabsorption ;	1
(ii)	<i>protein</i> high blood pressure / hypertension / AW ; damage to basement membrane ; not selective / allows protein through / AW ; AVP ;	2 max
	<i>glucose</i> <u>blood</u> glucose concentration above the norm / AW ; <b>R</b> in urine diabetes (mellitus) ; too little / no, insulin ; reduced sensitivity to insulin ; detail of action of insulin ; tubule cells cannot reabsorb it all / AW ; AVP ; e.g. too much glucose consumed, hyperglycaemic / glycosuria	4 max

continued

**Question 3 Expected Answers**  
cont'd

(c) *A ora throughout*

- 1 **homeostasis / osmoregulation ;**
- 2 ref to set point / **negative feedback ;**
- 3 **osmoreceptors ;**
- 4 in **hypothalamus ;**
- 5 stimulated by low **water potential ;**
- 6 **ADH** secreted ;
- 7 by **neurosecretory / nerve cells ;**
- 8 flows down axons ;
- 9 (into) **posterior pituitary ;**
- 10 released into blood ;
- 11 target organ / acts on cells of collecting duct ;
- 12 locks onto (**complementary**) **receptor ;**
- 13 in cell membrane ;
- 14 triggers enzyme ;
- 15 increases permeability to water ;
- 16 by increasing, **aquaporins / water channels** in cell membrane ;  
     **A vesicles with water channels fuse with cell membrane ;**
- 17 tissue surrounding collecting duct has low water potential ;
- 18 water moves from cells into, tissue fluid / blood / **vasa recta ;**
- 19 down water potential **gradient / by osmosis ;**
- 20 ref to **loop of Henle ;**
- 21 detail on influence on water balance ;
- 22 reduces volume of water flowing into bladder / more concentrated urine / AW ;
- 23 AVP ; e.g. detail on osmoreceptors, membrane receptors, controlled by ANS

**9 max**

**QWC - quality of use and organisation of scientific terms ;**

*award mark for at least four of the terms marked in bold*

**1**

**[Total: 21]**



Question	Expected Answers	Marks
4 (a)	(i) <i>normal allele</i> upper case letter, <i>mutant allele</i> lower case letter ; <i>letters must be clear which is which and both same letter</i>	1
	(ii) <i>using symbols above ecf, only penalise once in (i) even if sex linked alleles drawn</i>  (parents) Gg x Gg ; (gametes) G g G g ; (genotypes) GG Gg Gg gg ;  sufferer indicated as homozygous recessive ;	3 max
	(iii) autosomal ; recessive ;	2
(b)	(i) lipid essential for all cell membranes ; phospholipid ; cholesterol ; essential to make new cells / AW ; AVP ; e.g. ref to lack of lipid stores	2 max
	(ii) myelin sheath ; lipid layers / multiple cell membranes ; insulate neurone / <i>ora</i> ; no / slow, conduction ; <i>ora</i> AVP ; ref to saltatory conduction	2 max
(c)	(i) enzymes are protein ; digested (in stomach) ; by, protease / pepsin ; ref to effect of pH ; quicker / more direct into blood / AW ;	1 max
	(ii) to allow new cell membranes to form / AW ; for, growth / repair / replacement / cell division ; before differentiation ; inappropriate accumulation of lipid ; detail ; AVP ; e.g. before the immune system is mature	2 max

continued

**Question 4  
continued**

- (d) (i) 1 enzyme is, an antigen / foreign / AW ;  
2 immune response ;  
3 antibodies, complementary to / matches / specific to, enzyme ;  
4 may, destroy / surround / bind to / AW, enzyme ; **A** enzyme may not work  
5 (antibody reaction) makes the patient ill ;  
6 AVP ; e.g. pyrogens, histamine release,  
7 AVP ; detail on immune response *treat T cells as neutral* **4 max**
- (ii) memory cells ;  
vigorous secondary response ;  
anaphylaxis / described e.g. shock qualified ;  
specific antibodies could remain in the blood / (remaining) antibodies destroy the  
enzyme ;  
AVP ; e.g. tolerance lost **2 max**

**[Total: 19]**

Question	Expected Answers	Marks
5 (a)	<p>1 transmits impulse across synapse / neurotransmitter ; R message</p> <p>2 vesicles fuse with the cell membrane ;</p> <p>3 released / diffuses across, synaptic cleft ;</p> <p>4 locks onto receptors ;</p> <p>5 in post synaptic membrane ;</p> <p>6 changes shape of / opens, Na<sup>+</sup> channels ;</p> <p>7 Na<sup>+</sup> rushes in ;</p> <p>8 depolarises membrane ;</p> <p>9 generates action potential ;</p> <p>10 AVP ; e.g. ref to threshold</p>	4 max
(b)	<p>(i) fewer branches in Alzheimer's patient / ora ; neurones neutral - assume Alzheimer's if not qualified</p> <p>shorter branches in Alzheimer's patient / ora ;</p> <p>(ii) acetylcholine synthesised in synaptic knob ; stored in vesicles (in synaptic knob) ; fewer, synaptic knobs / synapses / terminals ; AVP ; R may produce less enzyme for acetylcholine production (in stem)</p> <p>(iii) use of growth factors ; factors which, prevent / slow down, nerve death ; ref to stem cells ; AVP ; e.g. named drug, enzymes which destroy scar tissue</p>	2  1 max  1 max
(c)	<p>5 max for list of symptoms (S) unrelated to structure structures must be in the context of the correct symptoms to be credited check Fig. 5.1 for functions related to structure</p> <p>1 cerebrum causes ;</p> <p>S 2 loss of (voluntary) movement / loss (voluntary) muscles ;</p> <p>S 3 loss of, ability to process information / cognitive functions / AW ;</p> <p>S 4 loss of (short / long term) memory ;</p> <p>5 caused by (loss in) hippocampus ;</p> <p>S 6 poor recognition ;</p> <p>S 7 loss of personality ;</p> <p>S 8 inappropriate behaviour / dementia ; e.g. imagines things, paranoia</p> <p>S 9 speech / language (centres) lost ;</p> <p>10 cerebellum causes ;</p> <p>S 11 loss of balance / poor coordination / described ;</p> <p>S 12 loss of fine manipulation / AW ;</p> <p>13 medulla causes loss of control of basic functions / named ;</p> <p>14 AVP ; e.g. slower reaction time</p>	9 max
	<p><b>QWC – legible text with accurate spelling, punctuation and grammar ; no more than three different spelling errors</b></p>	1

[Total: 18]

Question	Expected Answers	Marks
6 (a)	(i) secretes fluid to carry the sperm ; <b>A</b> seminal fluid	1
	(ii) <b>1</b> increases frequency / urgency of urination / dribbling urine ; <b>2</b> obstruction of, urethra / urine flow / AW ; <b>3</b> PSA test, positive / high ; <b>4</b> uncontrolled cell division ; <b>5</b> mitosis / cloned / genetically identical ; <b>6</b> enlarged prostate gland / noticeable lump / tumour ; <b>7</b> longer exposure to, carcinogens / mutagens, as age ; <b>8</b> proto-oncogenes / genes which control cell division, mutate / DNA changes ; <b>9</b> oncogenes ; <b>10</b> errors in mitosis / telomeres degrade, as age ; <b>11</b> AVP ; e.g. bone secondaries, blood in urine, loss of libido, erectile dysfunction, genetic predisposition <b>R</b> infertile	5 max
(b)	(i) triggers antibody production ; specific, cell marker ; <b>A</b> HLA <b>R</b> specific to prostate AVP ; <b>R</b> protein	1 max
	(ii) diagnosis not reliable ; only 60% with level above 10 ng cm <sup>-3</sup> will have it ; level will depend on initial size of prostate / AW ; prostate size varies between individuals ; may be benign ; slow growing in elderly ; not cost effective ;	3 max
	(iii) ultrasound scan ; MRI scan ; CT scan ; PET scan ; X-ray, qualified e.g. for spread in bone / shows dense cell mass ; bone scan qualified ; AVP ; e.g. biopsy, thermography, scan qualified	2 max
(c)	ethnic origin / race ; genetic ; black Americans have higher incidence than white ; diet ; detail on diet ; France and Italy both similar diet, but differ ; black American highest, Chinese lowest ; different exposure to mutagens / named ; comparative figs in support ; AVP ; e.g. could be due to different detection rates, unhealthy lifestyle qualified	3 max

[Total: 15]



**Question 7**  
cont'd

- (g) (i) gene mutation ;  
sex linked ;  
on X ;  
non-homologous section / AW ;  
recessive ;  
(failure to) produce, factor VIII / clotting factor ;

**2 max**

- (ii) *points may be taken from a genetic diagram*

recessive allele ; *if not given in (g) (i)*  
carried by, female / mother ;  
passed on by gamete with mutant X ;  
always expressed in male ;  
as only one X ;  
never passed by male to sons ;

**3 max****[Total: 20]****PAPER TOTAL 120**

# **Report on the Units**

## **June 2005**





## Chief Examiner's Comments

This was the first examination session in which the full range of examination papers was tested and was also the first 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 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. It is however, important to note that the textbook is **not** the specification and wider reading of both textbooks and 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.

The Examiners have seen less evidence of the very pleasing reading around the topics examined than in the previous two sessions. Extra information given in answers is always credited if it is relevant and this helped the less able candidates in previous examination sessions to improve their marks. Human Biology is a full Advanced Level specification which fulfils the QCA criteria for all Biology specifications. The Human Biology papers are designed to ensure that the full ability range is tested. The A2 papers inevitably contain more questions requiring the application of knowledge and proportionately less of the simple recall questions found on the AS papers. They also test the synoptic element. 30 of the 90 marks on 2866 and 60 of the 120 marks on 2867 are awarded for synoptic questions.

### Teaching tip

The content of the specification gives ample opportunity for class discussion which will assist all candidates to grasp the principles and concepts which apply to individual topics.

Choose a topic and brainstorm on the synoptic topics which could be tested with it. Ask the candidates to use bubble diagrams either on the board or on paper to indicate the topics which apply. These could then be shared amongst the group to investigate further for homework. This is good practice for both the Case Studies paper and the synoptic questions on the A2 papers.

Historically, Human Biology may have been regarded as 'easier than Biology'. This is not, and never has been, the case. This specification has been 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 by many of the candidates has made it possible for them to achieve their full potential and the Examiners would like to thank the candidates and teachers for the hard work that they have done. Candidates who have been thoroughly taught to a high standard have performed well across the ability range and this is very pleasing. Unfortunately the Examiners felt that there were a few cases where candidates had gaps in their knowledge, which appeared to be Centre based.

There is no substitute for thorough learning of the factual information which underpins the content. The Examiners try very hard to reward positive achievement but if there has been no attempt to answer the question, nothing can be done. Occasionally questions are missed, particularly those requiring a label or mark on a diagram or table.

#### **Teaching tip**

Candidates should train themselves to tick off each question and subsection as they are answered to avoid missing any questions. It is also advisable not to fold the examination paper over as they work as this often hides relevant information on the opposite side of the double page spread.

### **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. Terms for which detailed definitions are required are shown in bold in the specification and defined in the glossary of the approved text books. However there are many descriptive terms applied to the biological content which are not so defined. To understand a topic fully it is necessary to understand the meaning of terms likely to be found in specialist text books and web based resources of an appropriate standard. The specialist terms appropriate to a topic are likely to be used in examination questions and this is particularly likely on the A2 papers.

The use of command words such as describe or explain also causes difficulty. 'Describe' requires candidates to state, in words, the main points of the topic. 'Explain' implies some reasoning to account for the descriptive points. Definitions of command words used in questions may be found in Appendix E Glossary of Terms used in Question Papers on page 91 of the specification. These should be made available to candidates.

#### **Teaching tip**

Encourage candidates to study the glossary on page 91 of the specification. Choose a question which could be either 'describe' or 'explain' and ask the candidates to write the mark scheme for each command word.

The Examiners observed that the understanding of nutrition was poor across all the Human Biology examination papers. This topic is covered in the AS course learning outcomes 5.2.2.1 (c) and 5.2.2.2 (c). Further information is gained on the components of the diet in Module 2856 and 2866. As nutrition is so fundamental, these topics are also likely to be tested synoptically on the A2 examination papers. Energy is another central topic. The Examiners frequently came across the phrase 'energy is produced' which is never credited. The Examiners look for a phrase such as energy is 'released' or 'converted'.

The Human Biology specification is set in a 'real world context' and this principle is also applied wherever possible to examination questions. The question stem 'sets the scene' for the questions which follow. Whilst marks are not given for simply repeating the question stem, the information given in the stem is usually an indication

of what is required from the candidate. Far too frequently it is clear that candidates have not read the stem or indeed the question carefully enough.

Where human structures are illustrated, a photograph of the actual structure is more likely to be used than a diagram, to reflect the 'real world context'. It is appreciated that the identification of particular structures is more difficult from a photograph and therefore the questions asked and the mark scheme will reflect the degree of difficulty. If more detailed information is required, a diagram will be used.

### **Tables and Graphs**

Questions involving data in tables or graphs always involve marks awarded for accurate quoting of data. To illustrate the point the quoted figures usually need to be comparative and use accurate units. If the data are presented on a graph, both axes of the graph should be used. e.g. on 2867, question 2 (c) (i), a mark would have been awarded for any comparative quote on the European plot e.g. 71 kg at 1° C compared with 56 kg at 20° C. It is hoped that in the future, graphs on Human Biology papers will be drawn on a mm graph paper grid. In this case it is unlikely that any tolerance will be given for inaccurate reading of the axes. Candidates would find it useful to use a ruler to draw intercepts on the graph so that they might read the figures off accurately.

### **Presentation**

The standard of presentation is not usually considered when marking Human Biology papers. However, this session produced a number of examination papers which were very hard to read. The Examiners try extremely hard to decipher such papers but the risk to the candidate is obvious.

### **INSET**

OCR is offering a programme of in-service training for teachers on the delivery of the specification, during the Autumn 2005 and Spring 2006 terms. The booklet containing details of these INSET courses should have arrived in Centres during the Summer term 2005. Further information may be obtained from the OCR website ([www.ocr.org.uk](http://www.ocr.org.uk)) or by telephone on 0121 628 2950. A summary of the dates and locations is given below.

#### **Human Biology INSET Programme 2005-2006**

##### **CBIB601 A beginner's guide to delivering and assessing OCR's AS Level Human Biology (3886) - Full day**

London          Tuesday 15 November 2005

##### **A beginner's guide to delivering and assessing OCR's A2 Level Human Biology (7886) - Full day**

**CBIB701** Birmingham          Thursday 19 January 2006

**CBIB702** London                  Wednesday 25 January 2006

**CBIB801 Delivering and assessing OCR's Human Biology AS/A Level Coursework (3886/7886) - Full day**

London      Thursday 24 November 2005

**CBIB901 Improving the teaching and learning of OCR's AS/A Level Human Biology (3886/7886) - Full day**

This is a feedback meeting on 2005 papers.

Birmingham      Wednesday 1 February 2006

## 2856: Blood, Circulation and Gaseous Exchange

### General Comments

The paper was appropriate for the ability range. The overall performance of candidates showed that there still appears to be a high proportion of weaker candidates taking Human Biology. It appeared clear where Centres had used the text book to study procedures, as candidates were able to accurately reproduce the information on e.g. preparing a blood smear and using a sphygmomanometer, and gain full marks.

Questions involving data interpretation, biochemistry, calculations and coronary heart disease are likely to occur frequently in papers and it would be advantageous for Centres to ensure that candidates are familiar with these topics.

### Comments on Individual Questions

**Q.1** The first question was intended to be a relatively easy start to the paper, testing some GCSE concepts. Many weaker candidates seemed to be able to score over half marks on this question.

- (a) Few candidates correctly identified the neutrophil. Many incorrectly labelled it as a macrophage.

#### Teaching tip

In accordance with the main emphasis of this real-world specification, candidates will be expected to interpret 'real' images such as electron micrographs, CT scans etc. Good electron micrographs of blood and other mammalian tissues can be found at: <http://www.med.uiuc.edu/histo/small/atlas/objects.htm>

An excellent site for blood images is: <http://image.bloodline.net/>

Practice could also be given in the use of scales and magnification to increase numerical processing skills.

- (b) The definition of a tissue was very weak with few candidates specifying that the cells were of a similar, or of one or two types, of cells. Many candidates instead gave a definition of, or relationship with, an organ.

Candidates will be expected to know definitions for all key terms given in bold in the AS specification.

**Teaching tip**

Key definitions can be found in the glossary of terms at the rear of Human Biology AS, Jones and Jones (CUP). Alternatively <http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=mcb.glossary.7315> can be used as an online resource.

- (c) Some candidates misinterpreted this question, giving details of how to obtain a blood sample, and then merely stating add to a slide and use a microscope at the end hence failing to score any marks. There is concern that many candidates did not know the key terms appropriate to the technique such as cover slip, microscope slide, fixation. Some candidates discussed dyeing the blood smear rather than staining which is inappropriate, as is the use of iodine.

**Teaching tip**

Candidates should be encouraged to learn all procedures as a bullet pointed set of instructions which are hopefully more readily recalled in the examination. Alternatively candidates can draw up an annotated flow diagram of the procedure as an end-of-topic task which can be kept for revision purposes.

Teachers can gain information and procedures / proformas for using blood in laboratories from the CLEAPS Laboratory Handbook section 14.4.1

**Q.2** Disappointingly, several Centres appeared not to have covered the biochemistry section in sufficient depth to enable candidates to attempt this question. Several Centres had all candidates failing to score any marks on this question. As a bare minimum, candidates should be able to draw and link two alpha glucose (to make maltose), 2 amino acids to make a dipeptide and a glycerol and 3 fatty acids to produce a triglyceride.

- (a) The failure to link appropriate groups to a central carbon atom led to some candidates failing to gain credit for this question. A number of candidates attempted to draw a glucose molecule, a DNA molecule or a nucleotide.
- (b) (i) Generally candidates scored 2 or 0 marks on this question. Some again mistakenly gave names of bases or elements rather than groups within an amino acid.
- (ii) Many answered accurately, though a common misconception was the presence of a hydrogen bond.

(iii) Many candidates thought that this was condensation instead of hydrolysis.

**Teaching tip**

Candidates should be encouraged to construct a table relating to proteins, lipids and carbohydrates including the elements involved, names and structures of sub-units, bonds involved and functions. Clear diagrams showing these molecules can be found in *Advanced Biology*, Jones and Jones (CUP) ISBN 0-521-48473-1. Sources of a similar type of biochemistry questions can also be found on the OCR Biology Foundation (2801) papers available from OCR publications.

- (c) Many candidates failed to read the question and appreciate that the answer should be set in the context of haemoglobin (although credit was given for other proteins). Many also stated a fact about secondary structure for part 1, and then a second fact about the tertiary structure for part 2 without giving the counter argument for each and thus failing to score any marks.

Many candidates also talked about double helices implying some confusion with DNA structure. Many also implied that secondary structure involved a two dimensional shape whilst tertiary was a three dimensional shape, which is obviously not the case. Again there was concern regarding the number of candidates who could not answer this question accurately.

**Q.3** This question was designed to test the basic facts on blood and tissue fluid composition as well as the more difficult relationship between the two. Most candidates managed to score well on the first two parts.

- (a) This part was generally answered well with most candidates managing to score at least three marks. Worryingly, a number of candidates did not think that water was a component of blood. (Learning outcome 5.1.1.2 (f) )
- (b) The majority of candidates seemed to know that the flow of blood was from left to right. A minority of candidates omitted to answer this question, perhaps not reading the whole question or failing to spot the mark allocation in brackets.

**Teaching tip**

Candidates could be encouraged to put a tick / solidus through the bracketed marks for each (sub)question after they have finished the paper as part of their checking process. This will hopefully highlight any omitted sub questions.

- (c) This question was not answered well. Many candidates simply gave a straight definition of osmosis and water potentials without putting the definition into context. Very few actually talked about arterial and venous ends of the capillary or the role of plasma proteins in lowering water potential. A general concern expressed by examiners was the apparent lack of awareness of appropriate terminology by the candidates, such as water potential, solute potential and water potential gradient. At AS candidates will be expected to use these terms, as in the coursework component, rather than concentration or concentration gradient. Water concentration is a very misleading term. Many candidates did not understand the term hydrostatic pressure.

#### Teaching tip

A very clear explanation of tissue fluid formation can be found in Biology- Principles and Processes, Roberts, Reiss and Monger (Nelson) ISBN 0-17-448176-4. Modelling can also be very useful in explaining this concept. Further practice questions can be found on the OCR Biology Transport (2803) papers available from OCR publications.

At the end of each chapter, candidates could be encouraged to produce a glossary of all the key terms given in bold as a reinforcement task. These can then be stored to act as revision aids later in the course.

- Q.4** This question on the heart was accessible to all candidates. The most able scored highly, demonstrating a very good knowledge of the learning outcomes in the specification.
- (a) (i) This part was generally well answered by most, and even the weaker candidates managed to score well.
- (ii) This part question was drawing on knowledge from GCSE as well as this Module. Of those candidates who did not score well, many thought that the left ventricle wall was thicker because it had to withstand pressure rather than produce it. However, many candidates demonstrated a clear understanding of the double circulatory system with both circuits.
- (b) (i) (ii) Weaker candidates struggled with this part of the question. Few candidates recognised that the ECG shows electrical activity rather than blood flow. Although some knew that the P wave corresponded to electrical activity prior to atrial systole and QRS, ventricular systole, many went on to describe the sequence of events involving blood flow and valve movements and not the electrical activity, despite the fact that electrical activity was written in bold in the stem of the question. Another common misconception was that the SAN and AVN contracted to start the wave of contraction.



### Teaching tip

Candidates should complete two separate flow diagrams; one for blood flow and valve movements during the cardiac cycle and the other for electrical activity. A comparison can then be made linking the two together. Clear explanations can again be found in Human Biology for AS, Jones and Jones (CUP).

- (c) Many candidates suggested correctly that it would increase the heart rate, but failed to point out the obvious that it would be picked up by the ECG giving a distorted reading.
- (d) Many candidates scored well here. Most common answers were CHD, a hole in the heart or valve defects.

**Q.5** Overall the majority of candidates failed to score well on this question; many candidates scoring no marks at all on part (a). Most candidates were able to score at least three marks on part (b).

- (a) Few candidates gained 3 marks for this part of the question. Good candidates were able to discuss the fact that hypertension damaged arteries and then went on to discuss how this would lead to CHD using appropriate terms. Some candidates were able to gain one or two marks by referring to the specialist terms without specifically outlining the overall process of artery damage from hypertension and subsequent events. However, disappointingly, many candidates answered the question by describing CHD and hypertension, rather than outlining how one could lead to the other. In some cases a mark was lost by not referring specifically to arteries. Coronary heart disease is a disease that affects the coronary arteries and is a basic concept in this module. It will undoubtedly be tested in future examination papers. Too many candidates still have a superficial understanding, perhaps due to the layman's approach in the press and media?

### Teaching tip

A good flow diagram is given in Revise AS Biology for OCR. Fosbery, Gregory and Stevens. Page 72 (Heinemann). ISBN: 043558300X

- (b) The mark scheme allowed candidates to pick up 2-3 marks by showing basic knowledge of testing for blood pressure by placing the cuff on the arm and inflating it. However 'how the results are interpreted' produced misunderstanding as to what was required, with some candidates veering off to describe how to treat high / low blood pressure etc. Very few candidates knew how to measure the systolic / diastolic pressure

and what to listen for through the stethoscope. It was concerning that many candidates did not know the significance of the systolic or diastolic readings, confusing it with pulse rate / electrical activity / volume of blood. These misconceptions tended to be Centre based. Some candidates confused the sphygmomanometer with a spirometer. It was pleasing to see some candidates gaining full marks for this part of the question but equally it was obvious that some candidates had no idea about the use of a sphygmomanometer and gained no marks at all. The QWC mark was awarded for most cases where candidates had written sufficient information about the topic of blood pressure even if they had not specifically got the full context of the question.

### Teaching tip

Candidates should be aware that to gain the QWC mark answers should be legible, show evidence of good grammar and spelling and use appropriate specialist terms. As a consequence candidates that write in 'text language' will not be awarded this mark. It should be noted that bullet points, however, can be used without penalty providing spelling and grammar is correct. The use of flow diagrams depends upon the context and whether they add to the clarity of the answer. These should always be annotated.

**Q.6** Few candidates gained full marks for this question. There were a number of candidates who failed to spot the differences between the two tables and incorrectly referred to the smokers' table, Table 6.2 when they were asked to comment on deaths due to lung cancer in Table 6.1. This impacted on the marks awarded in part (a).

- (a) On the whole candidates scored either 0 or full marks for the calculation. Many candidates still experience difficulty with the basic method of calculating percentage using the general formula. Some also failed to round to the nearest whole number.

### Teaching tip

Teach the candidates the following formula: Percentage increase/decrease =  $\frac{\text{change}}{\text{original}} \times 100$

- (b) (i) The candidates who did not confuse the two tables managed to score at least half marks for this part of the question by looking at the trends for men and women. A reasonable number of candidates tried to quote figures, which Centres have obviously encouraged. Credit will continue to be awarded for this in future papers. However, candidates must be encouraged to quote units correctly too. In this particular case many missed out 'per year'.
- (ii) Most candidates were able to suggest that there was a link

according to the data for men and some were also able to see that there was no correlation for women. Very few candidates used any figures to support their statements so the majority of candidates failed to achieve the three marks for this question. In some cases, candidates did not distinguish between men and women merely stating that there was evidence that 'people' who smoked showed increased incidence of lung cancer.

**Teaching tip**

Take information from websites such as [www.ash.org.uk](http://www.ash.org.uk) or [www.statistics.gov.uk](http://www.statistics.gov.uk) and get candidates to describe trends in tables and graphs, practise calculations and suggest explanations for the data.

- (c) There were a surprising number of candidates who gave emphysema or bronchitis for this answer and in several cases a specific cancer, even though 'other than cancer and COPD' are stated in bold in the question. Most other candidates were able to give a suitable response for 1 mark.

## 2857: Growth, Development and Disease

### General comments

There appeared to be a general improvement in student performance this year, with very few questions unattempted. The fact that the textbook, Human Biology for AS Mary Jones, Geoff Jones CUP 2004 ISBN 0 521 54891 8, was available to these candidates obviously helped them in preparation for this examination. However, the textbook should not be regarded as an exclusive source of information as extra reading is always appreciated and facts gained are credited where relevant. Candidates last year demonstrated their enthusiasm for this subject and produced pleasing extra comment which was lacking this year.

### Comments on Individual Questions

**Q.1** While this question was reasonably straightforward it was also graded at quite a high level and few, if any, candidates scored maximum marks

- (a) Over half of the candidates produced the correct answer for the correct reason. However, many made a literal interpretation of the figure to give an XX answer, giving the answer as female. A few candidates muddled the sex of XY or XX.

#### Teaching tip

Candidates are expected to have seen a karyotype for both males and females and it is important that this is one taken from real life, rather than a stylised diagram, so that they are not expecting a set of chromosomes that look unrealistically perfect in shape.

- (b) Hardly any candidates attained full marks for this question. The majority gained one mark for giving an indication of seeing the chromosomes in amniocentesis. Some just repeated the stem of the question noting that 'chromosomal mutations are easier to detect'. Information given in the stem is never credited. Some went on to mention 'incorrect numbers of chromosomes', while better answers referred to named conditions observable from a karyotype. References to the relative difficulty of spotting chromosomal mutations compared with gene mutations were usually very generalised and often not specific enough to gain a mark.

**Q.2** This question provided a balance of long answers with short one or two word answers across the full range of grades, making at least some of this question accessible to all candidates. There was a generous marking scheme for part (c). Overall most students scored well on this question and some of the weaker candidates picked up many of their marks here.

- (a) (i) The majority of candidates managed to give at least one valid answer. A common error was to provide answers that were not specific enough, e.g. radiation, viruses, chemicals, rather than UV or ionizing radiation, a retrovirus a chemical mutagen or a named example of one. Occasionally incorrect answers referred to hereditary or genetic dispositions.
- (ii) This was set as the most difficult part of the question and many candidates struggled to score more than one mark. The majority of candidates did pick up one mark for attempted references to 'uncontrolled cell division'. Better informed candidates managed to tie together 'proto-oncogenes mutate to become oncogenes', picking up three additional marks, beyond a mention of uncontrolled cell division. However there was occasional transposition of proto-oncogenes and oncogenes in candidates' answers.
- (b) Increase in death rate with increase in smoking was almost universally referred to at some stage in each answer. Use of figures was quite well done, but a sizeable number of candidates multiplied the y axis scale by their reading of the graph e.g. 250,000, while others ignored the per 100,000 altogether, giving a straight reading from the graph, e.g. 250. A few mistook the x-axis for age.

It was uncommon for candidates to gain all three marks. Many gave enough detail to warrant awarding three marks; however the third mark was reserved for an explanation, which was given by few. The most commonly given explanation was the build up of tar or carcinogens in the lungs during the period when the person smoked. Few referred to the fact that other things lead to lung cancer, or the reversibility of some of the damage to the lungs in ex-smokers.

- (c) Overall, all but the weakest candidates performed well on this question. This also proved to be an opportunity for the weaker candidates to present their most successful answer. A high proportion of mid range candidates upwards scored maximum marks. Good candidates correctly referred to lobectomies, whilst some referred at length to the use of internal radiotherapy. Some candidates scored well but missed the QWC mark, by not using sufficient technical terminology. The term 'chemotherapy' was spelt with a great range of variations. Some candidates devoted a high proportion of their answer to diagnostic procedures (scans, etc.), which do not address treatments. Many opted for a lung transplant, which does not constitute a treatment. Others incorrectly referenced lumpectomies and mastectomies. Poorer candidates suggested 'giving up smoking' as a treatment. Some confused treatments, for example, describing the use of radiation in chemotherapy. Very few referred to immunotherapy. The term 'alternative' was sometimes mistakenly used instead of complementary. When complementary therapy was described, candidates gave a good indication of its use to support, rather than replace, conventional treatments 'to improve the well being' of patients.

**Q.3** Most candidates picked up some marks on this question. It was pleasing to see many candidates scoring both marks on the calculation question. It was only for (c) (iii) that the best candidates scored maximum marks.

(a) (i) This question was answered correctly by considerably more than half of the candidates, but incorrect answers came from across the ability range. A few gave answers that were not specific enough, e.g. sugar, while some transposed the answers.

(ii) The correct answer was provided by the majority of candidates. A few mentioned **double** hydrogen bonds, correctly drawn on the Fig 3.1, but this was credited as fortuitously there are two H bonds between A and T!

(b) Higher scoring candidates generally got this calculation correct. The correct answer was also provided, but to a lesser extent, by average and poor candidates. Sometimes, the correct calculation stood out in a poor script. Occasionally candidates got as far as calculating 36% A+T but failed to continue the calculation by subtracting this from 100 and dividing the answer by 2.

(c) (i) A correct answer was provided by most candidates, who seemed familiar with this type of representation of DNA replication.

(ii) This question was tackled with mixed success. Better candidates generally gained both marks, while among the remaining scripts, some managed to gain both marks and fewer scored a single mark. Generally, two marks were given for references to original strand and new strand. Some loosely grasped the concept of semi conservative replication of DNA, e.g. 'half is from original DNA', but this type of answer did not describe the mechanism of replication in sufficient detail to warrant a mark. Hardly any referred to the additional marking points which included conservation of the double helix and the new molecule is identical to the original molecule.

(iii) Many candidates gave generalised answers regarding size and the carrying of information, without giving enough detail to gain marks. Successful candidates most commonly mentioned accurate replication, but also gave a mixture of other answers addressing the template nature of DNA, molecular stability, the weakness of hydrogen bonds, the degenerate code and the potential for repair if one strand is damaged. Some pulled together these points e.g. 'complementary base pairing means it can replicate perfectly'. A few addressed the issue of the degenerate code. Some explored mutations and DNA as a tool for natural selection, without gaining credit as these points did not answer the question.

**Q.4** The question was largely targeted at the A / B candidate, but with scope for weaker candidates to acquire some marks. The latter however, struggled with their answers, even though most attempted an answer to all parts. The question proved more accessible to mid level candidates and upward.

(a) (i) Most candidates managed to pick up a mark for communicating the idea of the spread from one person to another. Occasionally the reference to 'spread' was too vague. Some referred to pathogens, bacteria and viruses without referring to cause, with the worst examples noting 'the disease is the pathogen'.

(ii) This question was targeted quite high, but almost all candidates managed to get a mark. This was due to candidates presenting one aspect of the importance of antibiotics e.g. 'help fight disease caused by bacteria' or 'previously just depended on immune system'. Few addressed two aspects of the importance of antibiotics, those scoring both marks usually made a general statement about effectiveness, supporting this with an example or with some reference to restricting the impact of major diseases.

(iii) The ability to provide two groups of organisms which produce antibiotics was very patchy across all candidates. Many gave one answer, generally fungi. Fewer mentioned bacteria. One or two gave named examples e.g. *Penicillium*. Incorrect answers often referred to a component of the blood, such as B or T lymphocytes or rainforest plants. An ingenious, but not credited answer was 'humans'.

(b) Many candidates struggled with this question; good candidates scored the majority of the marks, but full marks were rarely awarded. 'Not completing the course' was the most commonly provided answer. Slightly less commonly candidates also mentioned incorrect prescribing of antibiotics. The survival and multiplication of resistant strains was also mentioned by many. The idea of horizontal transmission was rarely mentioned. Other points were also less commonly seen and only featured in good answers. Some candidates touched on natural selection, generally without enough detail. A common error was to describe immunity to bacteria rather than resistance. Only excellent answers described antibiotics as the selective agent. Other less commonly encountered, but valid answers included a reference to bacteria acquiring multiple resistance.

**Q.5** This question appeared to meet its objective of being accessible to most candidates.

(a) Candidates successfully relating the type of reaction to the presence or absence of previous exposure to TB or the vaccine often gained all three marks for this straightforward description. e.g. 'if there are small puncture marks visible.....the person has not come into contact [with TB] and needs the vaccine, if there is a red ring the person has come into contact with it and does not need the vaccine'. Some did not give a complete

answer, omitting a description of the reaction or reference to previous exposure, or by not giving the converse answer. Almost all candidates managed to refer to the Heaf test being used to test for present or past exposure to TB, or to the need to test to see if the vaccine needs to be given or not. A considerable number gave a description of the test, instead of, or as well as, describing its role. A few mentioned further testing, and where an example was given, this was usually a reference to a chest X-ray.

- (b) The majority of candidates suggested the use of a chest X-ray. Many did not look beyond a single answer and very few went on to describe a second specific approach to gain both marks. Of those answers not gaining credit, some referred to generic check ups, while others just repeated the answer to Q. 5 (a).
- (c) Almost all candidates gained some credit on this question, referring to at least one course of action when a TB infection is confirmed. Many suggested isolation, many recommended notification of a health authority (or similar) or WHO. Good answers covered contact tracing and setting up vaccination programmes. Weaker candidates suggested a course of treatment for the patient with TB which was not credited.

**Q.6** The first parts of this question were targeted at the more able students. Many candidates struggled to give an accurate description of the graph in (a). However (b) and (c) were tackled with more success across the whole ability range.

- (a) (i) Better candidates managed to successfully describe the graph for body height. Of the remaining candidates, some made fundamental errors in their approach, giving vague descriptions or not acknowledging any changes in the angle of the slope with age. The use of figures was undertaken with varying degrees of success, often with candidates quoting changes across an inaccurate time span, or a long time span that does not acknowledge changes in the slope. Better answers used the figures correctly, often referring to 75% growth at 8 years as a start point, quoting ages 9-13 years as showing the fastest growth rate and referring to a levelling off at about 16+ years. Some candidates confused the two plots on the graph or failed to give units in a numerically accurate data quote.

(ii) Only a minority of candidates had any success with this question. Most answers simply gave an incorrect *description* of the graph whilst the command word in bold in the question was **explain**. The Examiners had hoped that candidates would target their answers around the particular function of the pelvis in the maturing female. There were quite a few near misses with marks in those who referred to puberty, but few qualified this reference by mentioning the hormonal influence. Others mentioned pelvis size without a strong enough reference to child birth; some made loose reference to adult size. Marks were only gained by those candidates who successfully related these points.



### Teaching tip

Graphically presented data is a common feature on Human Biology papers and a relatively easy way for candidates to gain marks. Candidates should practise the identification of trend lines, the more specific analysis of the data, and the accurate quoting of data with units. They should also concentrate on the difference between the command words 'describe' and 'explain'. A glossary of terms may be found on page 91 of the specification.

- (b) Most candidates mentioned some form of reference to menstruation and the need to replace blood or iron loss. Better answers mentioned the prevention of anaemia, or the lack of haemoglobin and therefore energy for growth.
- (c) (i) Over half the candidates made some reference to spinal cord development / malformation. Better answers correctly mentioned neural tube defects and / or spina bifida. A few candidates could only relate folic acid to health in a general way and these were not credited. e.g. 'to help foetal growth and development'.
- (ii) All four marks were fairly accessible to average / good candidates. Most answers referred in some way to the danger of infection of the mother and the spread of the disease to the baby, giving nearly all candidates at least one mark. Once candidates explored deformities it was not unusual for them to pick up all of the remaining marks from a list of possible problems. Good answers also referred to the need to vaccinate the mother three months before pregnancy. Some weaker candidates considered Rubella and German Measles to be two separate infections.

## 2858 / 01: Case Studies

### General comments

The overall standard of answer seen on the paper seems to have been higher than in the two previous sessions. Yet again there was evidence that some Centres had spent considerable time preparing their candidates. Centres need to spend time and explore several areas that could have potential questions. This is not only good preparation for the paper but also excellent preparation for the more synoptic approach that will be required in A2. The answers given to the extended question frequently contained information not given in the case study but which was relevant. As in previous sessions, this was given due credit. It was disappointing to see that the level of response to the questions on diffusion in the alveoli and on the function of vitamins and minerals fell well below that expected of AS. Both questions were of an equal standard and both produced a range of responses across the full mark range. Most candidates attempted every question and there was no evidence that time was an issue.

### Comments on Individual Questions

#### Q.1 HEART VALVE REPLACEMENT SURGERY

This question was based mostly on Module 2856, Blood, Circulation and Gas Exchange and, unlike the June 2005 paper, there was no evidence to suggest that candidates found this module easier than the question based on Module 2857, Growth, Development and Disease.

- (a) This was intended to be an easy introduction to the paper and most candidates scored maximum marks. The commonest mistake was for candidates to give a condition such as coronary heart disease or angina or to repeat the stem of the question and suggest valve replacement.
- (b) The examiners were surprised at how few candidates could describe the pressure changes responsible for opening and closing valves. All except the most able candidates described valves as 'shutting' or 'closing' rather than as *being forced* shut or closed and few made any references to pressure difference between chambers. A similar situation was seen again in the responses to part (d) – the interpretation of the pressure change graph.

#### Teaching tip

When teaching the cardiac cycle, present the graph in question (d) or a similar one and ask the candidates to 'talk through the cycle'. The valve sounds and an ECG trace can be superimposed on the graph. Graphs such as this are obtainable from Google Images and in standard A Level text books.

- (c) In an attempt to answer part (i) of this question, many candidates labelled the heart and, although this was not a requirement, where candidates labelled the left side of the heart correctly, they had no difficulty in positioning the arrow. The question did specify the bicuspid valve and therefore the left side of the heart. The Examiners noted that a few candidates did not attempt the question at all and had clearly not seen it.

**Teaching tip**

Train the candidates to put a line through each question and subsection number to ensure that questions, especially those which have no answer line and require an answer on a diagram, are not missed.

There were some excellent answers to part (ii) with some interesting descriptions of the sounds which a leaky valve would make (whooshing / slushing / 'not the normal lub' sound). Some candidates ignored the word 'detected' in the question and instead produced descriptions of possible symptoms such as fatigue or low blood pressure whilst others incorrectly suggested an ECG. Again, from the answers given in part (iii) it was obvious that weaker candidates particularly, had no concept of the pressure changes which occur in the heart and the reason for the changes.

- (d) The comments made above on pressure changes also apply here. A surprising number of candidates got one correct rather than both; evidence possibly of an 'educated guess' approach rather than a systematic understanding of the pressure changes occurring over a cardiac cycle.
- (e) There was an easy mark on this question as most candidates were well versed in the idea of a large surface area for gas exchange. Centres are not expected to teach Fick's Law, but this does give three parameters which affect the rate of diffusion i.e. surface area, concentration gradient and distance. Maximising the first two and minimising the third is the key to any gas or nutrient exchange surface. It was clear that this approach is adopted by some Centres since some low scoring candidates did manage to achieve full marks on this. A few candidates did not appear to know what was meant by ventilation.
- (f) This proved to be a difficult concept for the candidates. Answers to part (i) and (ii) suggest that some confused the heart lung machine with the kidney dialysis machine and suggested removal of toxins. As this was mentioned on the pre-release material it was expected that candidates would have studied it in preparation for the examination. Many more ignored the question stem and either made reference to gas exchange or to the surgical procedure. In part (i) the examiners were looking for references *either* to homeostatic functions such as blood pressure *or* body temperature maintenance or maintaining supply to organs and tissues other than the heart. Alternatively, reference could be made to safety features such as the need to prevent clotting or maintain sterility.

Credit was given to candidates who suggested that it was an opportunity to deliver 'drugs' rather than through the normal intravenous route. In part (ii) credit was also given to candidates who suggested that 'debris' might have entered from the machine but, again, many candidates made a vague reference to impurities which was not credited. Some candidates suggested that microorganisms could be removed by the filter and presumably forgot that anything fine enough to remove microbes would also remove blood cells. Some candidates referred to removing gases which again indicated a lack of understanding.

- (g) There was a lot of evidence that some Centres had done considerable background research into the sodium / potassium pump and credit was given for this. However, only rarely did the examiners come across good explanations of the hydrophobic nature of the phospholipid bi-layer being a barrier to ions. The word 'membrane' was used as if it was synonymous with bi-layer. Some good responses included labelled diagrams of the phospholipid bi-layer showing the transmembrane nature of the proteins. Very few candidates referred to the hydrophilic nature of the amino acids or R groups which would line the protein channels. A number of candidates did not attempt this question at all.

#### Teaching tip

In any exam question, the instruction 'Describe' should trigger the candidate to at least consider a **labelled** diagram. The structure of the cell surface membrane lends itself well to a labelled diagram.

Split the group into two. Instruct them to describe membrane structure with only one group being able to use diagrams. Provide the candidates with a mark scheme and see how they score on the two methods.

- (h) This proved a difficult question indicating that candidates have considerable problems describing the immune response accurately. Most candidates scored an easy mark by stating the valve was recognised as foreign with good candidates stating that this was due to the presence of antigens. However, some candidates wrote 'the immune system does not recognise the foreign tissue' which could not be credited. There were a few excellent descriptions of the processing of T cells in the thymus which makes it possible for the immune system to distinguish self from non-self but many weaker candidates made vague statements such as 'the body thinks they are harmful'. The Examiners were looking for the idea that the immune system *responds* to this challenge and a description of the response. Most candidates seemed to have the impression that the appropriate T cells or antibodies are already present and answers involving APC and clonal selection were rare indeed. The usual confusion between antibodies and antigens was noted in low scoring scripts. There was some confusion about the role of immunosuppressants and anticoagulants since both terms appeared in the case study.

## Q.2 PKU AND THE ROLE OF THE DIETICIAN

There was no evidence that candidates were struggling to finish the paper and extensive answers were given in part (b) though few scored full marks.

- (a) This was intended to be a relatively easy mark and it was clear that most candidates had been well prepared. A few candidates worked out the codons correctly but then failed to write down the correct amino acids. Some candidates used the triplets / codons / amino acids given in part (a) to illustrate their response to part (b) and this was credited. Some candidates wrote glutamate rather than glutamine although glutamate was not an option in the table.
- (b) This proved to be a difficult question with only high scoring candidates obtaining full marks. Many candidates failed to read the question correctly and went into great detail on the nature of point mutations rather than their effect. Some marks were available for this, but unless the candidate went on to explain how this led to the enzyme not functioning, they were limited to 3 marks at most. There was, understandably, some confusion with some candidates describing how the mutation led to phenylalanine being replaced by tyrosine in the enzyme structure. Good candidates referred to the phenylalanine as the substrate and the enzyme substrate complex. A poor grasp of terminology also let some candidates down with *protein* and *amino acid* being used interchangeably as were *letter* and *base* and *gene* and at least one candidate pointed out the enzyme would not fit into the active site of the phenylalanine! The examiners were a little surprised as a similar question to this was available to Centres in the specimen papers (See The Sickling Disease). A good AS standard of response is required with reference to changes in the primary and hence tertiary structure of the enzyme and a change of shape at the active site. Further marks were available for descriptions of the changes in mRNA and tRNA that a gene mutation would produce. It was clear that Centres had encouraged their candidates to research around PKU with many references to a substitution mutation on chromosome 12. Good candidates illustrated this with examples taken from part (a), frequently gaining marking points 1, 2, 3 and 4 in so doing.
- (c) This was intended to be an easy question but the level of answer given was generally not up to AS standard. Firstly, it was clear that many candidates did not know the difference between a vitamin and a mineral, with folic acid frequently being given as an example of a mineral. Secondly, vitamins A, D and folic acid are in the specification and candidates are expected to allocate a role to these vitamins. Too many candidates made reference to 'good eyesight' for vitamin A. The Examiners would have preferred to see reference at least to retinene formation or rhodopsin formation for Vitamin A and, for vitamin D, absorption and or deposition of calcium. However, some allowance was made and less detailed answers were not penalised if they were largely correct. The role of folic acid in neural tube formation was clearly well known and this was credited. Calcium and iron are also on the

specification and here answers were better, with many candidates referring to strengthening of bone and haemoglobin / red blood cell formation respectively. Weaker candidates referred to blood cell formation or even blood formation and these were not credited. Problems arose where candidates tried to discuss vitamin B rather than an example of the vitamin B complex. Similarly, many candidates gave vitamin C as an example but could not then give a satisfactory function with vague references to improving the immune system not gaining credit. Candidates who referred to the role of vitamin C in wound healing or collagen synthesis or as an antioxidant did gain credit.

- (d) Despite the question asking for a function 'other than nutrition', some weaker candidates referred to feeding at some level. Again there was confusion over terminology with some candidates referring to the transfer of *antigens* or *immunity*. However, this question was generally well answered.
- (e) There was an easy mark available in part (i) for any correct comparative statement regarding the differences in growth rate or pattern between boys and girls. The graph in part (ii) proved more difficult than the Examiners had anticipated, considering that this type of graph was clearly indicated in the pre-release material for this question. It was difficult to see how candidates could get one figure correct but not the other. The commonest mistake was to 'guess' where the intercept was rather than taking a ruler and using the graph. There was no tolerance given by the Examiners.

#### Teaching tip

It is recommended that candidates practise the drawing of intercepts to read accurately from graphical data. The grids on the graph indicate the precision to which the readings should be taken. Candidates should be made aware of this and to take careful note of all units on the axes.

- (f) The commonest mistake made by even high scoring candidates was to fail to quote relevant data. Most candidates correctly commented on the fact that the brain was fully developed. However, many went on either to re-iterate a comment about *development*, ignoring the comment in the case study that, although the limit is higher, there is still a recommended upper blood limit; the inference being that there is still some risk of brain damage although this is now lower and hence the raised levels.
- (g) This was a good discriminator, with able candidates picking up on the fact that the cases mentioned were not new. It was possible for candidates to score two marks from a simple definition of prevalence. i.e. the number of cases currently (one mark) in a population (one mark). Many weaker candidates were again confused by the terms with references to severity or low number being given.

**Teaching tip**

Construct a 'Word Wall' by pinning up key words and phrases on a notice board. These can be grouped by topic or be random. Use them as 'starters' or a 'quick quiz'. Alternatively, candidates can use them for self-assessment.

## 2866: Energy, Control and Reproduction

### General Comments

In terms of overall performance, the candidates displayed the full range of abilities, but with a bias towards lower performance, which was expected from this cohort's marks last year at AS level.

On the whole, poor use of English let many candidates down, as they were unable to express themselves clearly enough to be awarded credit, even when they *appeared* to understand the concepts. Performance was better on less scientifically factual questions such as those that required a discussion of ethics (Q3 and Q5). Some candidates produced very high quality answers and had clearly been extremely well prepared for the examination. A pleasing number of candidates, even ones scoring towards the lower end of the grade boundaries, performed well on the calculation questions; evidence of some excellent specific examination preparation by teachers and candidates. Very few candidates appeared to have been unable to complete the examination paper in the allotted time.

### Comments on Individual Questions

- Q.1** As usual, this first question was intended to be an accessible one, providing a gentle lead into the examination paper as reflected in the relatively low targeting of some sub-sections.
- (a) (i) It was apparent that many candidates were confused by a real-life longitudinal diagram of the eyeball and could not label the structures indicated.

#### Teaching tip

The Human Biology specification is by its nature, in a 'real world context' and therefore in some instances applied. Candidates should expect to see realistic pictures, photographs and diagrams on the examination papers. Teachers should ensure that candidates do not rely too heavily on stylised drawings when learning structures and get the opportunity to see actual sections of biological structures. A good range of these can be found on <http://images.google.co.uk/images> or in a relatively old text book published by Heinemann and called An Atlas of Histology by Freeman and Bracegirdle. It may now be out of print but may be lurking at the back of a book cupboard.

In order to allow for the inherent added difficulty of interpreting from a real picture of the eye, the marking scheme for structure A allowed either ciliary body or suspensory ligament.

- (ii) Most students failed to adequately describe the function of the choroid layer and referred to it 'holding the shape of the eyeball' or



'protecting the eye'. Some candidates scored one mark for describing its role in preventing internal reflection, but without mentioning the pigmentation that facilitates this, or the fact that it contains blood vessels. Candidates who simply stated that the choroid layer 'absorbs light' were not credited unless this was qualified. A few candidates had obviously seen a real eyeball and described the choroid layer as 'black'; this was considered credit worthy for the pigmentation mark.

- (b) (i) This section was more difficult as it contained synoptic marks. Very few candidates made the link between high blood pressure and ruptured capillaries or bleeding and the effect this would then have upon the function of the retina. Some candidates did not refer specifically to the effect on the **retina** as demanded by the question or they referred to 'bleeding behind the eye', which the Examiners were not happy to credit. A few candidates suggested that the build up of high blood pressure would deform the retina, which was considered a perfectly acceptable 'AVP'.

(ii) Again, synoptic marks were available on this section of the question. The examiners were surprised that so few candidates associated vitamin A with the production of retinal and rhodopsin. Many candidates simply referred vaguely to 'the retina not functioning effectively' or 'blurred vision', without specific mention of lack of vision in low light intensities.

- (c) Most candidates scored at least one mark on this question for correctly describing the fact that the pupil diameter gets smaller in bright light. No credit was given for the statement 'the pupil contracts'. Better candidates then went on to explain the roles of the radial and circular muscles, or described the action of the pupil as a reflex. Almost no candidates referred to the circular and radial muscles as working antagonistically. Most candidates explained why this reflex action exists, which was not required by the question and thus did not earn credit.

**Q.2** Many candidates scored well on this question, especially on the extended writing section. The QWC mark was not awarded as often as the examiners would have expected due, in particular, to poor spelling or practically illegible writing.

- (a) (i) Despite the straightforward nature of this section, few candidates scored three marks. Many candidates labelled brain lobe areas rather than brain structures. The three structures required as answers are the only ones specifically mentioned on the specification.

(ii) Many candidates produced excellent answers on how a CT scan works, scoring all the available marks. It was clear from their answers that candidates were familiar with looking at CT scans and had a good understanding of their mode of action. A few candidates confused CT scans with PET or other types of scan.

- (b) This section of the question was intended to be more difficult and thus was targeted at a higher level. More able candidates were able to link the idea of heroin mimicking enkephalins / endorphins with their activity at opiate receptors. Less able candidates simply stated that 'heroin makes the person feel more relaxed and not worry about the pain so much'.
- (c) There were some excellent answers to this part of the question, with candidates clearly engaged with the material. Most candidates used all the available line spacing. Some candidates however, wrote answers addressing either the effects of heroin and alcohol on the body, or treatments for drug addiction, both outside the scope of the question. Some candidates did not demonstrate a clear understanding of the distinction between the two types of dependency, or did not link the types of dependency to either heroin or alcohol.

**Teaching tip**

Teachers are advised that the Human Biology textbook 'Human Biology for A2' produced by CUP is not a complete resource for specification coverage and that as with any specification at Advanced Level, access to additional resources is desirable for candidates. This is also good preparation for the Extended Investigation and any further study.

A disappointing number of candidates were not awarded the mark for the quality of their written communication, often due to poor spelling of words that appeared in the question itself such as alcohol and dependency.

**Q.3** This question was well answered by the majority of candidates.

- (a) Most candidates gained at least one mark on this section of the question for writing about inherited factors or information being passed down in genes or chromosomes.
- (b) (i) A few candidates did not recognise the karyotype presented in the question and suggested that the X chromosome was an extra chromosome that should not be present, or that there were mutations on chromosomes 11 and 13.

**Teaching tip**

Candidates are expected to be familiar with realistic karyotypes for males and females, rather than simply having seen 'perfect' stylised diagrams of chromosomes.

Most candidates correctly identified that there was a missing 'X' chromosome in pair 23 / the sex chromosomes, thus scoring both marks. A significant number of candidates did not seem to know that Turner's syndrome is only seen in females and suggested that the missing chromosome could be an 'X' or a 'Y'. This error was not penalised again if carried forward to the next part of the question.

(ii) Most candidates made a correct statement about the fertility of the individual, scoring at least one mark. Many went on to explain why individuals were infertile, with reference to lack of development of the sexual organs, compromised hormone production etc. Better candidates went a step further and explained that half of the female gametes would lack an X chromosome.

(c) (i) Almost all candidates scored at least one mark for correctly suggesting antibiotics as a suitable treatment, with a pleasing number also scoring the second mark for saying why. A few lost the mark by mentioning the use of anti-inflammatory drugs, or simply stated 'drugs' without qualification. Other 'treatments' suggested involved using condoms during sexual intercourse suggesting that the meaning of 'treatment' was not fully understood.

(ii) Very few candidates scored the mark available for this section of the question. Most simply stated that men could also become infected, or suggested the data were included for comparative purposes, without appreciating the risk presented by an asymptomatic male who could infect many women.

(iii) Many candidates scored full marks for this section, providing excellent descriptions and explanations of the graphical trends. There were intelligent suggestions about better diagnosis leading to an apparent increase in transmission rates, increased unprotected sex, women being more willing to seek treatment than men and so on. A maximum of two marks was available for the description of the trends with the remainder for the explanation.

(iv) Most candidates scored at least one mark on this section for suggesting that the trend for other STDs was likely to be similar. Few candidates made an additional point e.g. that they may also be undetected, in order to score the second mark. Candidates should note the mark allocation for a question as a useful guide to the number of points required in an answer.

(d) (i) Many candidates discussed ethical objections to assisted reproduction as a whole rather than to the low success rate of IVF. Many candidates answered along the lines of 'against God's will' or 'against natural selection, infertile people shouldn't have children'. Neither answer addressed the question posed. The Examiners were concerned by the emphatic judgments expressed in some of the responses. Many candidates' answers however showed a sensitive appreciation of the emotional and financial burden of the low success rate of IVF.

(ii) Some candidates suggested answers such as surrogacy or egg donation, which are not infertility treatments as fertility is the ability to produce offspring. Many scored two marks for identifying two correct treatments. A few candidates wrote vague responses such as 'hormone treatments', which were not credited unless suitably qualified.

**Q.4** Most parts of this question were targeted at the higher end of the grade boundaries and it was clear that, as expected, many candidates found it difficult.

- (a) (i) A surprising number of candidates failed to score any of the marks for this section of the question. Many labelled C as the nucleus, demonstrating a lack of understanding about cell ultrastructure and the relative sizes of organelles.

**Teaching tip**

One again, it must be emphasised that candidates are expected to have seen real life diagrams and photographs of biological structures associated with this specification as this is consistent with the 'real world context' of the Human Biology course.

(ii) A pleasing number of candidates scored both marks on this calculation, with the most common error being one of scale, for which only one mark was lost.

- (b) This question dealt with a difficult area of the specification in a straightforward way. It was anticipated that the diagram shown in Fig. 4.2 would help candidates to orientate their answers. Sadly, many students did not attempt an answer to this section and, with one or two exceptions, most candidates wrote confused, muddled responses. Common errors included a description of the movement of calcium ions, or a description of oxidative phosphorylation in terms of the electron transport chain, but without reference to the movement of hydrogen ions. Most students did not seem to be able to identify structures D and E on the diagram provided. The formation of ATP during oxidative phosphorylation is an area that teachers and candidates should expect to be examined.
- (c) Most students scored either two marks or no marks for this section of the question. The Examiners were pleased by the number of candidates who did know the right answer and expanded the answer to mention either that water was formed or that  $H^+$  and  $e^-$  were involved in the reaction.

**Q.5** A pleasing number of candidates scored highly on the section of this question dealing with the biochemistry of performance enhancement – this is clearly being taught in many Centres in an interesting and relevant manner.

- (a) (i) Some candidates failed to attempt this section of the question and the examiners considered the possibility that this was due to them not reading the instruction, rather than not knowing the answer. Candidates should be encouraged to read all questions from the beginning as part of their examination preparation and not to skip information or instructions in the stem of questions. Few of the candidates who did attempt an answer, correctly ringed the nucleotide shown.

**Teaching tip**

When teaching the structure of ATP, it is worth noting the similarities between it and other nucleotides encountered elsewhere in the specification such as DNA and RNA. It is also useful to point out the similarities in structure to other substances containing nitrogenous bases e.g. NAD and NADP.

(ii) Many candidates scored both marks for this question, with good answers including ‘anabolic reactions’ or named examples, ‘active transport’, ‘muscle contraction’ and so on. No credit was given for answers such as ‘respiration’ unless qualified appropriately.

(iii) This section of the question was targeted at the higher grades and unsurprisingly many candidates appeared to find it difficult.

**Teaching tip**

Few candidates could express the inherent ideas of energy transfer clearly and teachers should encourage students to refrain from using statements that run counter to the first law of thermodynamics, e.g. energy is produced.

- (b) (i) A pleasing number of students scored two marks on this calculation and it is clear that many Centres are training students very effectively for this type of calculation.

(ii) Despite the synoptic nature of this section of the question, the examiners had anticipated that most students would find this an easy mark to score. Unfortunately a significant number of wrong answers were seen. The most common error was to write about the fate of excess glucose (‘converted to glycogen’, or ‘stored as fat’), rather than addressing the question about the fate of energy. Despite the calculation in (b) (i), the release of thermal energy during the formation of ATP was rarely mentioned.

- (c) (i) It was clear from the majority of answers to this section that candidates clearly understood different methods of enhancing

performance and how they work. The Examiners were delighted by the generally high quality of responses. Marks were lost where students referred to 'blood' being returned to the body during blood doping, rather than to the return of the red blood cells only.

(ii) Most candidates scored two marks for this section. The marking points referring to possible contamination of substances or prescription only drugs were rarely awarded

**Q.6** This question was poorly answered by the majority of candidates, with few responses generating more than half of the available marks.

- (a) A description of the process of oogenesis is a direct specification statement and, as such, candidates are expected to have learned the stages involved. The Examiners had intended this to be a mark-yielding QWC question but it was clear from the number of candidates who did not attempt an answer, that this is an area of difficulty.

**Teaching tip**

Those candidates who used an annotated flow diagram generally scored well and teachers are encouraged to use the construction of such a diagram as a useful teaching tool, both for oogenesis and spermatogenesis.

Many answers were very muddled and incoherent, particularly with respect to relating the phases of meiosis with the appropriate stage of oogenesis, and often scored no marks.

- (b) The majority of candidates scored at least one mark on this section, often for correctly identifying the production of haploid cells, or for recognising the importance of variation. Better answers additionally referred to independent assortment and crossing over.

## 2867: Genetics, Homeostasis and Ageing

### General Comments

The enthusiasm for this subject noted during last year's AS examinations was still evident and the hard work of both teachers and candidates was much appreciated.

2867 is likely to be a testing paper. Two hour papers are unusual for Biology examination papers and there was some evidence that candidates ran out of both time and energy. There was a tendency for candidates to over-answer the earlier questions in order to demonstrate how much they knew and then to run out of time so that later answers were increasingly brief. Each question has a maximum mark allocation and the best way to increase a candidate's score is to attempt an answer to every question initially and then to add more if time allows.

A surprising feature of the examination papers was the number of blank spaces left by the candidates. It is good practice to encourage the candidates to try and write something even if they find the question difficult. The examiners reconsider the mark scheme in relation to a sample of the candidate's answers and make every effort to credit relevant information. If nothing is written, then this is impossible.

Half of the available marks on this paper are for synoptic questions. Extending answers to cover the synoptic material is a skill which many candidates find difficult. Consequently, although mark schemes for synoptic questions are usually generous, the candidate effectively limits the number of available marking points.

#### Teaching tip

Brainstorm each topic as it is completed either as a homework or class exercise. Ask the candidates to do a mind map using bubble diagrams to indicate the various synoptic topics which could be accessed from the 2867 topic studied. Ask the candidates to suggest questions and write the answers on a separate sheet of paper for homework. This provides a topic revision resource as well as question practice.

Many candidates for this paper had difficulty in interpreting the terms used in the questions. Whilst we have made every effort to make the language used as accessible as possible, it is important that the specialist language necessary to understand the concepts for a full A Level Science should be understood by the candidates for this examination.

The questions are graded throughout the paper from A to E/U. It is therefore anticipated that some candidates will not be able to answer some questions. As is usual for an A2 paper, there are also many more marks for the application of knowledge and understanding, analysis, synthesis and evaluation and a corresponding reduction in the marks for simple recall when compared with an AS paper.

## Comments on Individual Questions

**Q.1** As is usual, the first question was intended as a relatively gentle introduction to the examination paper. However, many candidates found the terms and language used for restriction enzymes beyond them. This is learning outcome 5.4.1.2 (a).

(a) (i) The majority of candidates scored the mark for this question.

(ii) By contrast, very few candidates were able to show correctly where the restriction enzyme cut the strand despite the broad hint in the penultimate line of the stem.

(iii) Some of the incorrect answers to (a) (ii) were so inaccurate that they indicated a distinct lack of knowledge of the target site on the DNA strand; learning outcome 5.4.1.2 (a). Consequently, these candidates were unable to access the full range of marks for question (iii). The examiners had hoped that apart from noting the specificity of the relationship between the enzyme and its substrate (a synoptic mark), they would also realise that the target site was palindromic or alternatively was symmetrical. Some candidates were able to explain the sticky ends but surprisingly few noted that the bases on the DNA were complementary to the active site of the enzyme; a relatively easy synoptic mark. A common error was to refer to the *bases* on the enzyme rather than the amino acids.

(b) Those candidates who correctly described how one strand complements or determines the sequence of the other and illustrated it with a sequence, or an example of a base pair, scored two marks. Some candidates also mentioned that a purine paired with a pyrimidine. Others described how each strand runs in the opposite direction to the other, easily scoring three marks. However, many candidates could not find appropriate vocabulary to explain what is meant by antiparallel although they were on the right track.

### Teaching tip

Cut sugar paper shapes in different colours to represent the outline shapes of the four bases. Suitable shapes could be enlarged from those on p146 Fig. 8.4 in Human Biology for AS Jones and Jones CUP 2004 ISBN 0 521 54891 8. Ask the candidates to pair them up to form two DNA strands. This represents clearly the complementary and antiparallel nature of the DNA strands.

(c) There were some excellent answers to this question. However, a number of candidates missed the point and simply described the general features of stem cells rather than their use for gene therapy. Although it was possible to score full marks this way, the examiners had expected some reference to the fact that a gene introduced into one cell would occur in all cells arising from division of that cell. Marks could also have been scored by giving an example of stem cell tissue or of an appropriate disease which could be treated in this way. Many examples were not appropriate and there seemed to be an assumption that **any** genetic disease could be treated by stem cell



therapy.

**Q.2** This was a mark-yielding question which enabled candidates of all abilities to reach a reasonable score. However, misinterpretation, and failure to maximise marks on the data, underline the need to practise this skill.

(a) (i) The majority of candidates scored maximum marks for this question.

(ii) Marks were lost by simply repeating the information in the question. To gain the mark for the production of thermal or heat energy the phrase needed to be in the context of an appropriate metabolic process. e.g. 'respiration increases and heat is a byproduct of this process' would have scored two marks. Some candidates provided excellent descriptions of how thermal energy is released during ATP production due to the inefficiency of the coupling process. A common error was to give descriptions of where the use of ATP releases thermal energy without qualifying it in an appropriate context. e.g. in muscle contraction. 'Friction' in this context was not considered an adequate answer.

(b) (i) Most candidates noted the need for an optimum temperature for the enzymes and the denaturing or inhibiting effects of variations in core temperature. However, the mark scheme for this question covered a wide range of effects such as the effect of high temperatures on fluid and electrolyte balance and the effect on the brain. For those candidates who expanded their answer with extra details such as these, three marks were easily obtained, but two was the more usual score.

(ii) There were very few correct answers to this A graded mark. The mark could have been given for the simple observation that the body could not maintain the temperature any lower or by a reference to the balance between heat loss and heat production. Most candidates failed to gain a mark by simply stating that exercise increased the temperature. This information had already been given in a previous question.

#### **Teaching tip**

The answer to this question could be demonstrated in class by conducting an experiment in which the temperature of a sample of students is taken at regular intervals during a period of exercise and for a period afterwards. This demonstrates not only the difficulty of dissipating heat during exercise, but also the dynamic effect of a homeostatically controlled process. There is also an opportunity to emphasise scientific method and analyse the results statistically as a preparation for the Extended Investigation.

(c) (i) Many candidates completed the calculation successfully but a few lost a mark by ignoring the request to give the answer to the nearest whole number. Some candidates struggled. Common errors were transposing the two readings or failing to subtract 60 from 68 at the beginning.

(ii) Most candidates were able to identify the trend for the European population. Marks were also gained for the quoting of comparative figures to illustrate this point, together with appropriate units. Some candidates either misread the scale of the graph or did not give units at all, losing an easy mark. Many candidates were less successful at explaining the data. The extraction of relevant data to illustrate the answer to the question is one of the easier ways of gaining synoptic marks. The definition of the terms 'describe and explain' are given in the glossary on page 91 of the specification and should be rehearsed by the candidates during question practice. A consideration of the surface area to volume ratio is an important part of temperature control in humans, and was mentioned by only a few, whilst the ability to dissipate heat is a limitation on exercise. Some candidates completely misunderstood the graph and thought that the data were for individuals rather than a characteristic of a population. e.g. the observation that body mass decreased rapidly.

(iii) This question was a synoptic question on the principles of evolution. Marks could have been gained by the simple statement that maintaining the temperature was an advantage. More difficult marking points were the consideration of how much metabolic effort was required to maintain body temperature if adaptation had not occurred. However, there were also many basic marking points on the general principles of natural selection. Many candidates scored full marks but an equal number missed the point of the question entirely and simply extended the answers to (b) (ii).

(iv) This was intended as an easy question where candidates could gain two quick marks by noting that factors such as diet, disease, stress etc could all affect mass. The answers were numbered to help candidates to provide only two suggestions, one on each numbered line. Candidates should be encouraged to answer this type of question in this way. Some candidates gave two answers on one numbered line and another on the second line. In this case the Examiners mark the first two answers regardless of the lines and reject the third. If one of the first two answers is wrong and the third correct, the candidate needlessly loses a mark by not answering the question. The Examiners cannot pick answers from a list.

**Q.3** Candidates found much of this question quite difficult but many provided excellent answers to section (c).

(a) (i) Most candidates found this question very difficult. Some gained marks for the blood pressure by stating that the efferent artery was narrower than the afferent. Those who opted for the effect of the heart lost marks by referring to the contraction of the heart rather than the left ventricle. The use of terms such as 'particles', rather than ions or plasma proteins, which lower the water potential of the blood also lost a mark. Few candidates understood that the large volume of glomerular filtrate in the

Bowman's capsule would push against the basement membrane.

(ii) The poor understanding of the relationship between the pressures involved during ultrafiltration was indicated by the errors on the equation. The examiners had hoped that candidates could simply deduce the correct equation from Fig. 3.1 if they did not fully understand the pressures. Many candidates put  $-BP$  at the end of the expression e.g.  $WP-CP-BP$ , whilst others simply removed the bracket from  $BP - (WP + CP)$ . There were however a number of correct answers.

(b) (i) The majority of candidates did not read the question and stated that the process which forms urine from the glomerular filtrate was ultrafiltration rather than the correct answer, selective reabsorption.

(ii) There were few informed answers to explain the high concentration of protein. Hypertension is both a synoptic topic (2856) and studied in learning outcome 5.4.2.4 (a) as one of the commonest causes of kidney disease. Most candidates scored one mark for the observation that protein was allowed through but few mentioned the damage to the basement membrane caused by high blood pressure. Some thought that protein was 'high' rather than stating that it should not be there at all. Explanations of why glucose was so high were rather more detailed. Good answers included reference to diabetes and distinguished between no insulin and failure to respond to insulin. Many also explained the action of insulin to account for the effect of its absence and suggested that the high blood glucose level resulted in failure of the tubule cells to reabsorb it all. This scored well over the maximum mark for this section. However some candidates assumed that glucose was allowed through due to damage to the membrane and scored no marks.

(c) This question was well answered by candidates across the whole ability range. However, some candidates left this section blank whilst others produced a rambling account that was not credited. Well informed candidates went easily through the process and scored well in excess of the maximum. Less able candidates scored marks for the structures involved but lost marks by the use of vague phrases such as 'low water level' rather than low water potential or 'cell walls' rather than the cell membranes of the tubule cells. Some candidates think that the osmoreceptors secrete ADH. The Examiners were pleased to note that many candidates understood well that the ADH is produced by the hypothalamus and passes down axons to the posterior pituitary for release. The correct use of the terms and the correct sequence of the process gave the QWC mark. A few candidates only gave general descriptions of kidney function, which did not score marks.

**Q.4** The questions on genetics were well answered by the majority of candidates but the synoptic questions in questions (b) and (c) posed more difficulty.

(a) (i) Most candidates were able to select an appropriate single letter in upper and lower case although inevitably there were those who used two

different letters or expressed the alleles as heterozygous and did not score this mark.

(ii) The genetics was done well and those candidates who worked through the cross by means of an annotated punnet square and identified the individual with the disease scored a maximum without difficulty.

(iii) Most candidates scored the mark for recessive but fewer described the condition as autosomal recessive and scored two marks. Candidates should note carefully the mark allocation as this indicates the number of facts required for an answer.

- (b) The majority of candidates failed to cover the synoptic points on the mark scheme and therefore this question was low scoring.

(i) The synoptic material tested here involved the role of lipids in the body e.g. phospholipids, cholesterol and their necessity for the formation of cell membranes; learning outcome 5.1.1.1 (g). Few marks concerned the inappropriate storage of lipids, the aspect dwelt on by most of the candidates who scored in this question.

(ii) As the synoptic nature of question (b) was not addressed by most candidates, this part of the question was difficult for all but a few. Marking points mainly considered the role of lipids in forming the membrane layers of the myelin sheath; learning outcome 5.3.2.2 (c). More candidates scored a mark for observing that nerve impulses stopped or slowed but the use of the term 'messages' was not credited or the term 'affects' without qualification as to how.

- (c) (i) Most candidates scored a mark by observing that ingested enzymes are digested or denatured by the low pH in the stomach. Others mentioned that injection was directly into the blood and therefore quicker.

(ii) Marks were given here for the need for lipid to form new cell membranes and therefore cell division during growth. Marks were also given for descriptions of the damaging effects of excess lipid deposition. Some candidates scored a mark for the statement that the injection was better given while the immune system was still immature. There were a number of vague answers lacking in factual detail.

- (d) (i) A good description of the immune response would have scored maximum marks for this question. Few candidates achieved this but most achieved some marks for noting that the enzyme was an antigen or foreign material. Some of the descriptions of the immune response were totally inaccurate or lacked factual detail.

(ii) Most candidates managed one mark here either for stating that antibodies may remain in the blood or for a reference to memory cells. Few described the vigorous secondary response or the potential for anaphylaxis.

**Q.5** Parts of this question were answered very well but the extended answer presented some difficulties for the candidates.

- (a) There were some very good answers to this question with good sequential descriptions of the passage of the impulse across the synapse. Some candidates however, lost marks with poor terminology such as messages, post synaptic clefts or knobs, and few technical terms. It was also clear that some candidates had very little idea of the processes involved.
- (b) (i) Most candidates scored full marks for this question although expressions such as larger or smaller were not credited. If the answer was not qualified it was assumed that the candidate was describing the neurones in the patient with Alzheimer's disease.  
  
(ii) Candidates lost marks here by loosely referring to neurones rather than the precise site of acetylcholine production such as the synapse or the synaptic knob.  
  
(iii) Most candidates scored this mark, stem cells being the most common answer. The most able candidates mentioned growth factors or enzymes to break down scar tissue.
- (c) This extended answer question turned out to be quite difficult for some candidates. Some candidates did not read the question carefully. Rather than relating the symptoms of Alzheimer's disease to the relevant area of the brain, they either listed the symptoms of Alzheimer's disease in isolation, related them to the wrong areas of the brain or described the functions of these areas in normal circumstances. The Examiners did their best to maximise the candidates' marks but only those candidates who went through each area systematically, describing for each the effects of loss of function, scored full marks. In order to credit the candidates for the facts they knew, the mark for the structure was rejected if in the context of the wrong function, but the symptom of Alzheimer's disease was accepted even if it was in the same sentence. Most candidates scored the QWC mark for legible text with accurate spelling, punctuation and grammar but illegible writing was the commonest cause of not awarding it, although the Examiners used a magnifying glass in some cases to credit the candidates with their marks.

**Q.6** On the whole this question was answered well.

- (a) (i) Many candidates scored this mark although some were well wide of the mark. A common wrong answer was 'testosterone production'  
  
(ii) Most candidates scored at least four of the five marks for the signs and symptoms of prostate cancer. In some cases a mark was lost by the confusion over the spelling of urethra. However, fewer accessed the synoptic marks by referring to the mutation of proto-oncogenes into

oncogenes. Most candidates who did touch on this topic simply said 'mutation' without saying of what. Rather more candidates realised that longer exposure to carcinogens could be a contributing factor and that the cause of the cancer was uncontrolled cell division. The more able candidates also added relevant comment on benign prostatic hyperplasia as a condition which is characteristic of ageing and presents in a similar way to prostate cancer.

- (b) (i) Candidates found this A grade question hard and did not mention the role of this antigen as a specific cell marker. Information given in the question is not credited.
- (ii) The problems associated with diagnosing prostate cancer using the PSA test were well understood by most candidates. However, although the maximum mark was often scored, none mentioned the natural variation in the size of the prostate gland and consequently in PSA production. Some candidates produced good ethical arguments on the wisdom of diagnosis for a usually slow growing cancer. Some candidates erroneously thought that the test itself was unreliable rather than the diagnosis from the test.
- (c) More able candidates had no difficulty with these data and scored maximum marks. However, a considerable number of candidates failed to analyse the data systematically and scored few marks as a result. Figures were often given without the units, or were incorrectly described e.g. 82 or 82 000 cases rather than 82 in 100 000. The figures on the graph were given in a standard form for population data.

**Q.7** Parts (e) and (f) were answered well by many candidates but the genetics involved in the inheritance of the HLA system was not well understood.

- (a) Few candidates scored this mark. The wrong answers e.g. 80 indicated misinterpretation of the data or a lack of understanding of the topic which is covered in learning outcome 5.4.1.4 (a).
- (b) Rather more candidates gave the correct answer for this question but again many wrong answers indicated a poor understanding of haplotypes or the HLA system.

The more up to date text books now state the number of loci as 6. These questions were set some time ago when the accepted number was 4.

**Teaching tip**

The principles of inheritance of these four linked loci can be demonstrated using 8 stud Lego Duplo<sup>®</sup> bricks in different colours.

- (c) The Examiners anticipated that all candidates would score two easy marks here by substituting in the equation given. However, a few candidates managed to get the substitution completely wrong. A number did not understand the significance of the bracket in the expression and converted it to  $\frac{20 + 21}{2}$

As formulae are usually given to increase accessibility for questions involving statistics, this is worrying.

- (d) Many candidates noted that some alleles were more common or rarer whilst others stated that a perfect match is not necessarily required. However, few candidates scored more than one mark. Marks could also have been scored by noting that some alleles cause less vigorous rejection than others or that a living donor could be used. The obvious point, that the alleles are linked, was a rare answer.
- (e) Most candidates scored at least three marks for identifying the brother as the most suitable donor as he had his haplotypes from the same parents and had a 0.25 probability of having the same haplotypes. However many candidates did not mention the relative merits of the son or the partner, which would have been credited.
- (f) (i) This question was answered well. Candidates were clearly well rehearsed on the biological and ethical problems of organ donation.
- (ii) A surprising number of candidates did not make the synoptic connection between the liver and the production of clotting factors. Those who did failed to note the mark allocation and did not give an example, consequently scoring only one mark. Many wrongly suggested that the connection between liver disease and blood which does not clot was gene linkage rather than accessing the synoptic mark on clotting factors.

## **2858/02 and 2868/01: Investigative Skills and Extended Investigation (Coursework)**

### **General Comments**

It was encouraging to see that this year showed a substantial increase in the number of candidates entered for Human Biology. This was in part due to an increase in the number of new Centres as well as a substantial increase in number of candidates within established Centres. The work submitted showed evidence of tremendous hard work on behalf of the teachers and the candidates. There was work from candidates reflecting a wide range of ability which had been recognised in the marking by teachers. This year there was a larger number of Centres who had implemented different investigations, with a pleasing number of Centres selecting Human Physiology investigations (see advice later in the report).

### **General summary**

There was evidence that Centres from the previous session had on the whole taken on board the comments and advice made in their moderator's report and at INSET and gained confidence in the application of the descriptors. Thus Centres who had been adjusted last session were not necessarily adjusted again, or had a lower adjustment, this year.

Whilst there was a slightly lower percentage of candidates gaining a grade E this session this was primarily felt to be due to the large increase in new Centres, with no previous experience of OCR Biology, who had misapplied the descriptors. This led to candidates being adjusted downwards.

Many Centres sent well organised packages with customised mark schemes and tick lists to support the I skill. However it should be noted that it is a requirement to send the Centre Authentication Form with the scripts. This can, along with other forms, be downloaded from the OCR website. This can be found by following the following links:

AS/A level GCE + Sciences > AS/A level GCE Human Biology > Publications and Materials > Centre Authentication Form

Centres who were adjusted fell into 3 main categories i.e. Centres who had:

- misapplied the hierarchical mark scheme
- omitted a descriptor in the candidates' work
- chosen an inappropriate task.

Each of these areas is discussed, and advice given, in later sections of this report.

The Evaluation skill was an area where many candidates failed to achieve the higher sub descriptors. In some cases, this was in part due to misinterpretation of the sub descriptor. The use of writing frames or structured report writing can reduce the content and time spent marking this skill, but does not lose individuality. Suggested tables and frames are given later in the report.

Another key area where candidates did not provide sufficient evidence was in the S skill at A2. It should be noted that the listing and evaluation of the sources is expected to be



in a report **separate** from the Planning task.

More information is available in the 'Teacher Support: Coursework Guidance' published by OCR and available from the publications and materials page of the OCR website. Centres are also able to gain more detailed feedback regarding this year's moderation, or proposals for next year, via the coursework consultancy service, available free of charge, via the Subject Officer. In the forthcoming academic year there will also be various **Human Biology specific INSET** days where more detailed and specific advice can be sought. Centres who were new to AS this academic year and are embarking on the A2 course in September are strongly advised to attend before starting the A2 coursework.

### **Tolerance**

AS: A tolerance limit of plus or minus four marks (out of 60) is applied to the AS investigative skills. If the difference between the moderator and the Centre fell between these limits no adjustment of the marks was made. However, if the difference was greater than this (either plus or minus more than four marks) then an adjustment was made in the appropriate direction by the full amount. Hence a Centre with a difference on average of minus four would not be adjusted but a Centre with an average difference of minus five would be adjusted downwards by five marks across the cohort.

A2: A tolerance limit of plus or minus six marks (out of 90) is applied to the A2 Extended Investigation. The limit is set higher than at AS to take into account the additional 30 marks from the additional three skills (searching, recording and making a presentation). The tolerance limit is set at 6% of the total marks available. If the difference between the moderator and the Centre fell between these limits no adjustment of the marks was made. However, if the difference was greater than this (either plus or minus more than six marks) then an adjustment was made in the appropriate direction by the full amount. Hence a Centre with a difference on average of minus six would not be adjusted but a Centre with an average difference of minus seven would be adjusted downwards by seven marks across the cohort.

It should be noted, therefore, that in some cases Centres were not adjusted at A2 when they were at AS due to the different levels of tolerance, despite the work being marked by the same staff.

### **Adjustment of candidates marks**

Candidates in a Centre will have their marks increased or decreased as a result of the Centre falling outside the tolerance limit. This will occur if:

- all the candidates entered have been uniformly over or under-assessed in which case a single adjustment will be applied to the whole Centre.
- candidates towards the top of the Centre's rank order have been over or under-assessed more than the rest of the sample then a tapering scaling will have been applied. This will mean that the top candidates were adjusted to a greater extent than those candidates at the bottom of the rank order.

In either case the rank order of the candidates from a Centre will remain unaltered, but there may be a compression of the mark range.

Please note that as soon as a Centre falls outside the tolerance limit scaling adjustments

can be made using the marks appropriate. Where Centres were found to be significantly outside of tolerance a further sample was requested from the Centre. The second sample was moderated and the evidence used to support or modify the initial moderation.

Internal moderation is a specification requirement and indeed can highlight inconsistencies before the external moderation process and possibly reduce or prevent the scaling adjustment to the Centre. This was not always evident in some Centres.

### **Context of the investigation(s)**

To enable the moderator to have an understanding of the background of the investigation it is very helpful if Centres provide Moderators with sufficient information about the context in which the work was set and the limitations on apparatus and materials within the Centre. This is vital if Moderators are to be able to take into account the apparatus available to the candidates and therefore make allowances for the precision and accuracy of the data collected.

Information for each investigation might include:

- details of the theory taught prior to the investigation,
- preliminary work undertaken by candidates,
- apparatus availability/restrictions;
- precision of apparatus available is also invaluable e.g. balances, gas syringes and colorimeters.
- time allocation provided

### **Mark Schemes**

Many Centres did include customised mark schemes with their sample and this was appreciated. Whilst the moderation process refers to the OCR generic descriptors it is beneficial for moderators to be aware of the Centre's expectation for each sub descriptor. It should be noted however, that it is preferred that these should be presented in the format stated in the Coursework Guidance handbook i.e. using sub descriptors such as P5ai, P5aaii, P5aaiii. The use of sub descriptors by teachers can help prevent levels being wrongly awarded due to the oversight of one sub descriptor. This in turn helps to prevent the work falling outside of the tolerance limit.

Centres should note that it is a requirement to provide evidence for the 'a' strand sub descriptors in the I skill. This may be in the form of a tick list for all the candidates or the 'a' strand descriptors can be annotated next to the single, raw data table that is used to assess the I skill. If there is no such evidence work can be moderated back to zero for this skill.

Centres should note that a Coursework Advisory Service is available, without charge, for the review of mark schemes and advice on suggested investigations. These should be sent to OCR through the Subject Officer. A senior moderator will then produce a written report for the Centre within 6-8 weeks.

### **Hierarchical nature of the mark scheme**

On occasions Centres had not recognised that the mark scheme must be applied in a **hierarchical** manner to all four skills. This inevitably led to adjustments being necessary.

In marking a piece of work, the descriptors for the lowest defined mark level should be considered first and only if there is a good match of all the sub descriptors at that level should the descriptors for the next level up be considered. When a teacher is considering awarding a mark, the work must have demonstrated a good match to all the mark descriptors below the mark to be awarded.

For each skill, the scheme allows the award of intermediate marks 2, 4 and 6 that are between the defined mark levels. An intermediate mark may be awarded when the candidate meets all the descriptors for one level e.g. level 3 in planning **and** also meets **50%** of the sub descriptors for the next level e.g.

- i) all of P5a (i.e. P5ai, P5aii and P5aiii) **or**
- ii) all of P5b (i.e. P5bi and P5bii) **or**
- iii) 50% of the P5a and P5b e.g. P5ai, P5aiii and P5bii.

The award of 8 marks for the P and A skill has caused some difficulties for some Centres this session. The mark is intended only for the candidates who have clearly performed outstandingly in one or both of these skills. One approach to deciding whether it is appropriate to award 8 marks, is to consider how easy it is to read and mark the work. If one can read the work straight through, allocating all 7 marks without hesitation or searching through the report, then the candidate may well deserve an 8. The concern is that if 8 marks are awarded and the moderator feels that one of the sub descriptors at level 7 has not been met then the mark will be adjusted by minus 2 (or minus 4 out of 60) which puts the candidate on the boundary of tolerance through only one skill. It is not necessary for a candidate to go beyond the specification to gain 8 marks. Also candidates who write excessively in an attempt to score 8 might not be awarded P7aii due to irrelevance, or A7bi on the grounds of failing to be concise.

### **Annotation**

In general, much of the work submitted for moderation was clearly annotated, although it was not always the case that **all** the matched descriptors had been annotated. Annotation is usually in the format shown in the table below, with sub descriptors being identified clearly:

Annotation	Meaning of annotation
Tick + sub descriptor ✓P.3aii	Evidence found here for complete match with the descriptor
Cross + sub descriptor i.e. xP.3aii	No evidence for this descriptor therefore overall mark for this skill limited at this point
Sub descriptor in brackets (P.3aii)	Partial evidence found for this descriptor at this point in the work

## Nature of tasks

Common tasks included enzyme investigations e.g. the effect of temperature, enzyme concentration, substrate concentration and pH, membrane permeability with temperature and alcohol and osmosis. These investigations were suitable for all four skills and allowed access to the higher descriptors.

Centres are advised to avoid the approach where each candidate carries out a different investigation. Whilst it cannot be denied this approach is of significant educational value, particularly where candidates report back to the rest of the class on what they have discovered, the concern is the amount of work done. It is difficult to achieve standardised marking where the candidates present a portfolio of evidence. The moderators' concern is that internal moderation often breaks down, particularly where there is a difference in experience of the teachers concerned.

### a) Human Physiology investigations:

Concern rose this year regarding the inappropriate use of Human Physiology investigations. Whilst some are listed in the Teacher Support: Coursework Guidance handbook, it should be noted that this does not mean that they all have the potential to gain full marks in each of the four key skills. The main area of concern and cause for adjustment this session was due to the failure to meet 3 key sub descriptors. **The details given below are meant as amplification of the sub descriptors and is in no way an alteration to the specification.**

P3a<sub>ii</sub> In the case of Human Physiology investigations it is paramount that the candidates recognise the vast range of factors which should be **considered** when dealing with Human subjects.

P3b **Repeats** are needed for reliability to be assessed, so at least 3 replicates should be **planned for**. If this plan is to be analysed it should be noted that the calculation of a mean is less reliable with data taken from less than 3 readings. 3 readings will also aid the identification of anomalous results for use in skill E.

A **range** of 5 in the independent variable is expected, but the exact number depends on the context of the investigation and the independent variable studied. If in doubt the Centre should contact the Subject Officer at OCR.

For P3b it is preferred that candidates should **plan at least 10 subjects** in each of three categories, as this is good practice. It is realised that this is not always possible to implement and so **data** must then be collected from a minimum of ten subjects in a minimum of two categories.

Another concern is the selection of the individual subjects. In some cases candidates were selecting from a very narrow age range, yet trying to determine the effect of ageing on aspects such as memory, recovery time etc.

P5b<sub>i</sub> Candidates are required to give a detailed description of the strategy, including apparatus and variables, which allows it to be repeated by another student. Candidates should be encouraged to ask 'can this be followed by another student?'. The strategy should enable data to be collected to the same degree of precision and reliability.

Another area of concern was the ethical nature of some investigations. In the Teacher Support: Coursework Guidance handbook an investigation into the suitability of snacks for diabetics is listed. It was envisaged that this would involve the testing of the glucose content of the snacks using a colorimeter / Benedict's test and **not** the direct testing on human subjects. It was of great concern that on one occasion a subject had had their glucose levels detected at four times the upper limit of the normal glucose range. Whilst the candidates have the initial responsibility for assessing and determining safety and ethical issues related to their investigation(s) it is also the responsibility of the teacher to ensure that the task does not put subjects at risk.

b) Secondary data investigations:

When choosing secondary data investigations it is imperative that candidates indicate their sources and provide evidence of the methods used to obtain the data e.g. search engines and web sites used. The candidates must also select appropriate data and record it in a suitable and appropriate manner.

In the I skill a 'screen dump' is acceptable for I1a. To gain credit for I3b candidates will be expected to reformat the data collected to aid clarity. I3b cannot be credited for a series of 'screen dumps'. For I5bi secondary data must be reformatted accurately from its original source. Reformatting and selecting specific data from the original source is necessary for I5bii e.g. selection of certain columns/rows of data and exclusion of unnecessary/irrelevant data. I7b is assessed by ensuring sufficient data have been collected and recorded to allow reliable conclusions/comparisons to be made.

For secondary data investigations, discussion of the strategies to collect the primary data could be used to credit E5ai. E5aai requires candidates to suggest the use of different search engines/different sources, collect data from other recognised organisations (different bias), use of double-blind studies, the use of face-to-face questionnaires rather than written anonymous questionnaires.

c) Tasks for A2:

Suitable tasks are suggested in the Teacher Support: Coursework Guidance handbook, but again these do not automatically give access to all the higher sub descriptors. More details of the areas of concerns of these investigations will be discussed in depth at future INSET.

It is imperative that the thrust of an investigation originates in the A2 specification. For example an investigation which looks at the effect of pulse rate before and after exercise can easily permit candidates to base their prediction and analysis on the method used to measure pulse rate and the scientific knowledge and understanding (SK&U) related to pulse rate, without the emphasis being placed on the SK&U taken from the A2 specification i.e. exercise. In this case the work is likely to fail to meet P5ai, P5aiii and A5bi and A5biii. The same can occur when candidates investigate topics heavily reliant on SK&U related to enzymes e.g. 'the effect of temperature on respiration'. The emphasis here should be on respiration from the A2 specification using knowledge of enzyme action in this context.

It is equally important that higher ability candidates should have the opportunity to use AS SK&U to support and **underpin** their A2 SK&U to allow them to meet the synoptic sub descriptors in the P and A skills (P7aiv, A7aiii and A7biii).

To ease the workload on teachers and laboratory technicians it is possible for candidates to pool data and/or work from a common method. To implement this, the candidates should individually plan an investigation e.g. effect of temperature on respiration. These

plans should then be taken in and marked. The teacher can then distribute a common method e.g. stipulating the temperatures available, hence restricting the number of water baths required to those available in the Centre. However, the method should still follow best practice and leave the decisions in the planning, regarding the number of repeats, precision and accuracy of the data, to the individual candidates, regardless of what is available in the Centre.

### **Individual skills common to both AS and A2**

#### **Planning:**

An area in which candidates found it hard to achieve was P7b. Candidates should **explain** why the choices in the apparatus and strategy **planned** have been made in order to give precision and reliability in the results. How the key variable(s) will be controlled will show how reliability can be improved.

Candidates should be cautioned that if they word-process work, it should have accurate spelling, punctuation and grammar throughout the plan (and analysis) to gain credit at P7aiii (and A7aii). Additionally superscript and subscript should be used and be correct, when appropriate.

#### **Implementing:**

As this skill is largely assessed by the teacher it is necessary that Centres include a tick list or other written explanation of exactly how candidates were allocated marks for each descriptor. Annotation for the I skill should be next to the table used for the assessment of the skill and should include raw data. Annotation should also cover the sub descriptors of the 'a' strand. Centres should note that the 'a' strand assesses the manipulation of the apparatus/technique and strand 'b' assesses the recording of data/observations.

In several cases candidates' marks were adjusted due to the use of 'split tables'. In general all **raw data** should be displayed in a **single table** to allow a comparison to be made of the independent variable range and the replicates. The independent variable should be in the first column with SI units for both the dependent and independent variable in the appropriate row/column heading(s).

If, due to the volume of data collected, it is impossible to organise the data in one single table, the data should be organised such that all comparable data is in a single table e.g. all three replicates for each sugar / temperature / group of subjects. However, this will not score higher than 6 marks. Data that are split such that each trial / run is in a separate table will not score higher than 4 marks for the I skill.

The Moderator will assess P7bii in the light of the apparatus used and the appropriate degree of precision selected by the candidate. No written evaluation of this will be necessary. Hence if a measuring cylinder has been used then volumes would be expected to be recorded to at least the nearest  $0.5 \text{ cm}^3$  (i.e. half of the smallest interval that can be measured).

Where this skill has been completed as a stand alone skill (AS only) then an informative

title must be present.

Analysis:

Again this year Moderators had to adjust some Centres downward as no evidence of processing of data could be found. In these cases the candidates' mark was reduced to zero. This was more common in candidates who have relied solely on secondary data.

A3a is the presentation of the processed data e.g. a histogram or bar chart used in the correct context (bar charts to represent discrete data and histograms to represent continuous data). Whilst the use of ICT is to be encouraged, candidates should ensure they can use the packages at a suitable standard to produce a graph of suitable quality. There should be sufficient horizontal and vertical grid lines to allow new intermediate data to be extracted accurately. In several cases graphs produced using software packages such as Microsoft Excel<sup>®</sup> did not fulfil this criterion. All graphs should also have an informative title, axis labels, appropriate units on both axis and an appropriate line drawn. Given below are some examples of suitable and unsuitable graphs.

Fig. 1 **Poor example** which will not meet A3a

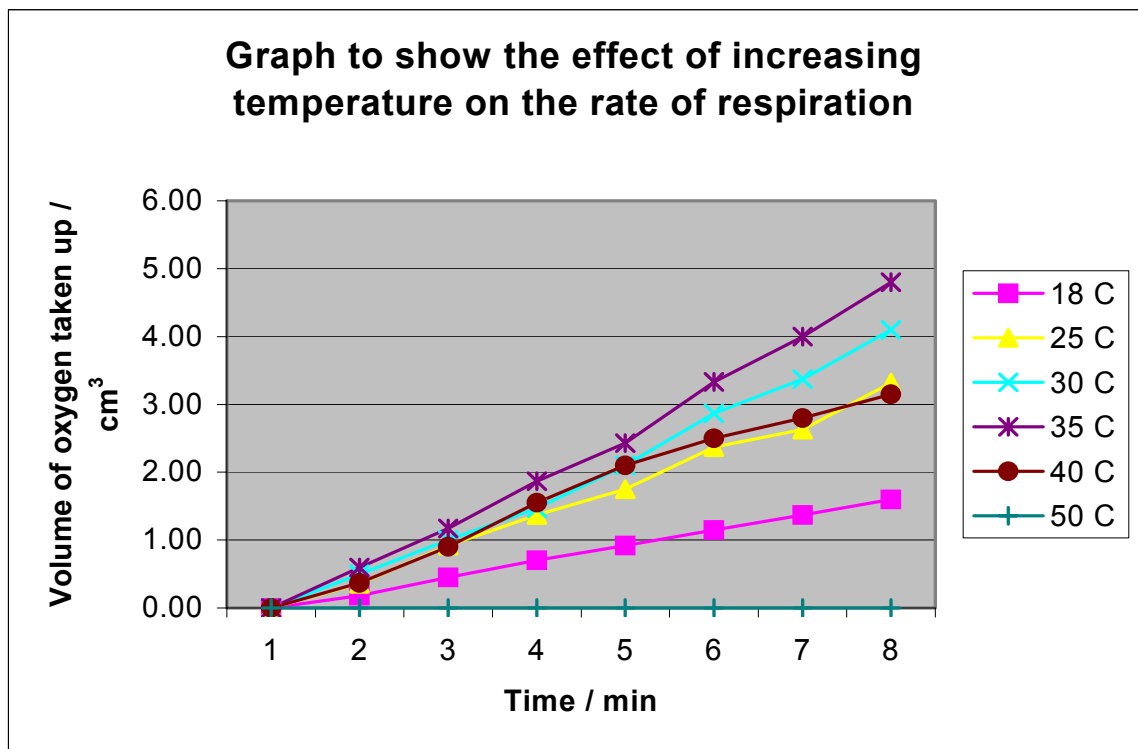
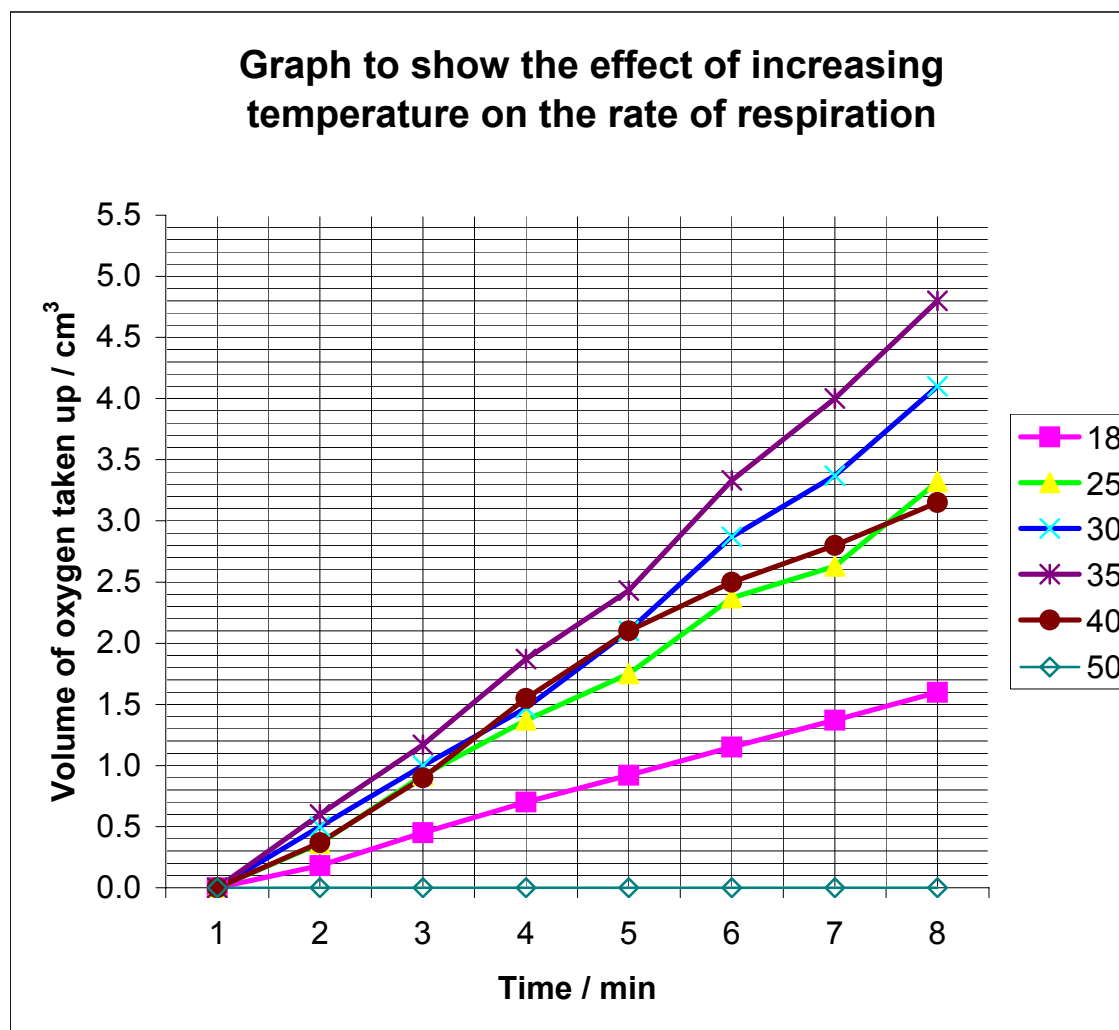


Fig. 2 **Minimum** standard to meet A3a



In some cases candidates were incorrectly awarded A5a for a graph. This is not appropriate. A5a requires detailed numerical processing e.g. the calculation of the standard deviation (this can be used to aid the progression through the Evaluation skill), deduction of an intercept, percentage increase/decrease or appropriate use of statistical testing. Centres should note that plotting **range bars** does not meet A5a as no further numerical processing has been undertaken. Standard error bars however are acceptable.

To gain A7ai candidates must **use** the **processed** data within their trends / conclusions and discussion. The incorrect use of significant figures, units or terminology, including super- and sub-scripts, within the report would prevent the awarding of A7aii.

The 'b' strand concerns the assessment of conclusions drawn. A1b requires candidates to draw a simple conclusion / trend from the data. A3b requires scientific knowledge and understanding to be linked to the processed data. The higher descriptors of the 'b' strand require conclusions to be linked with **detailed** scientific knowledge and understanding of an AS or A2 standard (A5bi) and linked coherently, comprehensively yet concisely for A7bi. A5bii requires appropriate key terms to be used in the discussion from the AS or



A2 specification.

Again care should be taken by Centres to ensure that candidates base their discussion on the SK&U taken from the A2 specification to enable A5bi and A5biii to be met. Candidates should also have the opportunity to be able to use AS SK&U to support and underpin their A2 SK&U to allow them to meet the synoptic sub descriptors (A7aiii and A7biii).

### Evaluation:

Centres are strongly advised to draw the attention of both teachers and candidates to the definitions of accuracy, precision and reliability in the Coursework Guidance Handbook. In brief, 'accuracy' is the closeness of the data to the true value, 'precision' is a measure of the accuracy i.e. the number of decimal places to which the data has been recorded, 'reliability' is the degree to which the same value will be collected each time the task is repeated.

Some candidates failed to make any comment on the data they had collected e.g. by indicating the presence/absence of anomalous result(s). As a consequence they failed to meet E1b and hence scored 0 marks for the E skill.

To gain E3bi candidates can calculate / comment on the % error, comment on the accuracy for piece(s) of apparatus, **or** comment on how the trend line compares to the theoretical trend line. Whilst E3a is the identification of all the limitations (problems in the method) in the procedure, E5ai is a clear **indication** which limitation(s) cause the **greatest** impact on the data. This can be done by simply ranking the limitations, but other techniques may be used. Considering the closeness to the mean, variance, size of the range bars / percentage error / standard deviation/standard error etc, can all be used by candidates to assess reliability, and hence meet E5bi. For E5bii the candidates must explain what impact the main error(s) (inaccuracy in the numbers), has on the data and how it is affected e.g. if data (raw or processed) is increased / decreased as a result of the error(s). Finally, to gain E7b the candidates should comment concisely on their data stating if it is accurate, precise and reliable enough to be confident in their conclusion, with reference to their prediction/expected results.

## A2 specific skills only

### Searching for information

The main area of concern in this skill was that some Centres had failed to realise that this report was separate from the 'Plan' and as such rarely scored higher than 3 marks out of 5. Candidates are expected to submit a separate concise report of 500-1000 words on the information gained from the resources stated in the bibliography (S1b). It is important to stress that the report is about resources used in the planning and not about the whole investigation.

Within the report candidates must show a minimum of 5 sources of information, correctly referenced (S1a). This can be presented in table format and extended to allow access to S3a and S5a as detailed below and at the INSET for Human Biology Coursework. The candidate should provide evidence of the information that has been selected and used in the report (separate from the Plan). The information should also be accurately referenced within the report (S3a). Within the report candidates are expected to show the selected material in a **variety** of presentational techniques in an organised manner (S3b). To gain S5a candidates should **explain** their choice of diagrams, charts, data etc selected from the sources listed in terms of the usefulness to the investigation and validity

of the information presented in the source, and finally for S5b the report produced should **coherently integrate** the information gained from the sources with evidence of a variety of presentational techniques such as tables, graphs and pictures.

resource	material selected from the resource	evaluation of the material selected from the resource

### **Recording an interview**

Whilst almost all candidates asked ten **appropriate** key questions (R1a) several candidates failed to ask supplementary question(s), or provide evidence of which question(s) were supplementary and consequently did not meet R3b. Candidates should plan questions which are appropriate for the interviewee and questions which will provide answers to aid the development of the plan e.g. to clarify suitable apparatus, to determine suitable ranges / values, to provide information to aid the prediction (R3a). If the questions are structured in a logical and coherent manner then R5a can be awarded coupled with R5b if there is also evidence that the candidates has evaluated the supplementary question(s) and the interview as a whole.

question asked	person asked	how the answer affected my investigation

### **Making a presentation**

Some candidates sent photographs of models / posters or printouts of their power point presentation/OHP copies as evidence for this skill. Whilst sending these is **not** a requirement it was greatly appreciated by the Moderators.

For each of these three skills teachers are required to complete, as a minimum, the tick list for S, R and M which is available from the Subject Officer at OCR and in the Teacher Support: Coursework Guidance handbook page 44.

### **Suggested writing frames/tables**

These tables can be used to guide the candidates, without unfair assistance, in the fulfilling of various sub descriptors. Depending on the depth and detail of the content within the table the sub descriptor(s) may be partially or full met.

#### **Apparatus list:**

Item [P1b]	Quantity	Concentration and Volume [possibly P3b]	What is it used for	Reason for choice [P5bi/P7b]

#### **Table to show how concentrations of working solutions will be made [P7b]:**

End concentration	Volume of stock solution	Volume of .....

**Table to show key variables:**

Variable [P3a <sub>ii</sub> ]	Type of variable (dependent/independent/controlled)	Why it must be controlled [P7b]	How it will be controlled [P5b <sub>i</sub> ]

**Table to evaluate the investigation:**

Rank order of limitation with qualification [E5a <sub>i</sub> ]	Limitation in method [E3a]	Error caused as a result of the limitation i.e. effect on the data collected [E5b <sub>ii</sub> ]	Suggested improvement [E5a <sub>ii</sub> ]	Justification of improvement [E7a]

Centres and teachers new to the OCR specification, or starting the A2 course for the first time, are strongly advised to attend a Human Biology specific INSET meeting during 2005-2006. Details are available on the OCR web site and are available in Centres from the Summer term.

It is also recommended that Centres and Teachers read the Human biology Coursework Handbook: 'Teacher Support : Coursework Guidance' , code number 7886 / 3886 / CWG1 obtainable from the publications and materials page of the OCR website [www.ocr.org.uk](http://www.ocr.org.uk)

Centres are reminded that there is a Coursework Consultancy service that is provided without cost. Details are available on request from the Subject Officer.

**Advanced Subsidiary GCE Human Biology 3886**

**Advanced Level GCE Human Biology 7886**

**June 2005 Assessment Session**

**Unit Threshold Marks**

<i>Unit</i>		<b>Maximum Mark</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>u</b>	<b>Total Number of Candidates</b>
<b>2856</b>	Raw	60	46	40	34	28	22	0	1006
	UMS	90	72	63	54	45	36	0	
<b>2857</b>	Raw	60	45	39	33	27	22	0	1380
	UMS	90	72	63	54	45	36	0	
<b>2858/01</b>	Raw	45	34	29	25	20	15	0	1372
	UMS	60	48	42	36	30	24	0	
<b>2858/02</b>	Raw	60	48	42	36	31	26	0	1362
	UMS	60	48	42	36	30	24	0	
<b>2866</b>	Raw	90	65	57	49	41	34	0	175
	UMS	90	72	63	54	45	36	0	
<b>2867</b>	Raw	120	84	74	64	54	45	0	268
	UMS	120	96	84	72	60	48	0	
<b>2868</b>	Raw	90	72	64	56	48	40	0	267
	UMS	90	72	63	54	45	36	0	

## Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	<b>Maximum Mark</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>U</b>
<b>3886</b>	300	240	210	180	150	120	0
<b>7886</b>	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>U</b>	<b>Total Number of Candidates</b>
<b>3886</b>	3.1	13.9	43.0	59.7	80.7	100.0	1261
<b>7886</b>	6.2	21.7	50.0	74.4	96.1	100.0	263





**OCR (Oxford Cambridge and RSA Examinations)**  
**1 Hills Road**  
**Cambridge**  
**CB1 2EU**

**OCR Information Bureau**

**(General Qualifications)**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [helpdesk@ocr.org.uk](mailto:helpdesk@ocr.org.uk)

**[www.ocr.org.uk](http://www.ocr.org.uk)**

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**Head office**  
**Telephone: 01223 552552**  
**Facsimile: 01223 552553**

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