

Oxford Cambridge and RSA Examinations



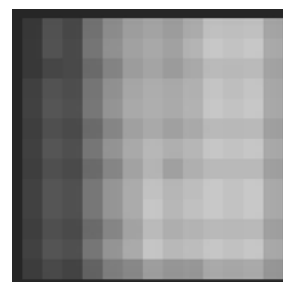
ADVANCED GCE  
ADVANCED SUBSIDIARY GCE

A2 7886  
AS 3886

# HUMAN BIOLOGY

**COMBINED MARK SCHEME  
AND REPORT FOR THE UNITS**  
JANUARY 2005

AS/A2



3886/7886/MS/R/05J

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

The report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

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RECOGNISING ACHIEVEMENT

Mark Scheme 2856  
January 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
	( )	= (underlining) key words which <u>must</u> be used to gain credit
	—	= error carried forward
	ecf	= alternative wording
	AW	= accept
	A ora	= or reverse argument

Question	Expected Answers	Marks
1 (a)	A protein / extrinsic protein / receptor protein; B carbohydrate tail / glycoprotein / poly saccharide;	2
(b)	26000 / 3428000;  = 0.007 $\mu$ m / 7.5 / 7.6 / 7.58 nm;  <i>correct answer only;;</i> <i>ecf (answer in correct units);</i>	2
(c)	separate contents from outside; carriers / channels / pumps / receptors / adhesion sites; relevant eg; selectively / partially permeable / AW; cell recognition; endocytosis / AW; exocytosis / AW; AVP; eg (facilitated) diffusion, antibody release, HIV and T helper cells, osmosis	3 max

[Total: 7]

Question	Expected Answers	Marks
2 (a)	<p>globular / tertiary;  four;  iron / Fe;  oxyhaemoglobin / HbO<sub>n</sub>;  3-4 months;  spleen / liver;</p>	6
(b) (i)	<p>same concentration as blood / plasma;  (a cell) has the same (solute) concentration / water potential / AW;  as the surrounding solution;  no net flow of water;</p>	2 max
(b) (ii)	<p>allows to continue for longer;  reference to replacing salts / ions / minerals;  (isotonic drink) same concentration / water potential as blood / body fluids;  boost blood volume if dehydrated / AW ;  adjusts water potential / no water potential gradient;  no <u>net</u> flow of water, between cells and blood / AW;  by osmosis;  ref to lack of stimulation osmoreceptors / inhibit ADH;  no excretion of ingested fluid / AW;</p>	<p><i>reject 'maintains water potential'</i> 3 max</p>

[Total: 11]

Question	Expected Answers	Marks
3 (a)	<i>surgical techniques</i>	
	1 bypass;	
	2 <u>vein</u> from leg / other part of body;	
	3 inserted into heart's own blood supply / AW;	
	4 bypassing blockage / AW;	
	5 in coronary artery; (allow once)	
	6 angioplasty;	
	7 catheter / balloon;	
	8 fed into coronary artery / circulation;	
	9 inflated to flatten plaque / stretches artery / AW;	
	10 insertion of stents;	
	11 heart transplant;	
	12 from donor / artificial heart;	
	13 immunosuppressant drugs / described ;	
	14 athrectomy / described;	
	15 'cut and suck';	
	16 AVP; e.g. artificial veins, internal mammary artery bypass, use of animal tissue, use of heart/lung machine, use of sand bags over puncture site	
		5 max
	<i>social, ethical economic</i>	
	17 ref to cost;	
	18 donor cards / donor availability;	
	19 waiting lists;	
	20 traveling abroad for organs;	
	21 smoking and allotment of funds;	
	22 cultural / religious objections to animal tissue / invasive surgery;	
	23 AVP;	
		7 max
	<b>QWC – clear well organised using specialist terms;</b>	1
		<b>[Total: 8]</b>



Question	Expected Answers	Marks
4 (a)	<p>(i) thromboplastin;</p> <p>(ii) calcium (ions) / <math>\text{Ca}^{2+}</math> / Ca;</p> <p>(iii) fibrin;</p>	3
(b)	<p>blocks / reduces circulation / blood flow (to certain tissues);            death, of tissue / named tissue / organ;            in coronary artery;            causing heart attack / MI;            (due) to lack of oxygen / glucose;            causing stroke;            in lungs, pulmonary embolism;            inability to absorb oxygen;            AVP;</p>	3 max
(c)	<p>moving causes increased heart rate / circulation;            calf / skeletal muscles maintain circulation by squeezing veins;            platelets less sticky;            less chance of clotting;            ref to preventing pooling of blood;            AVP;</p>	3 max
(d)	<p>ref to named clotting enzyme; e.g. thrombin</p> <p><i>competitive</i>            same shape as substrate;            occupies active site;            denying site to substrate / AW;</p> <p><i>non-competitive</i>            attaches to enzyme outside of active site;            active site may change shape;            substrate no longer fits;</p> <p><i>reject "inhibiting active site"</i></p>	3 max

[Total: 12]

Question	Expected Answers	Marks
5 (a)	<p>(i) for comparison / samples different sizes / AW;</p> <p>(ii) <i>look for explanation of separate age groups or combined</i></p> <p>1 general upward trend;            2 peaking in 1994;            3 downward trend (after 1994);            4 figures to support (both axes);            5 higher rate of increase in 0-4, than 15+;            6 more cases / higher frequency in 0-4;</p> <p><i>reasons (qualified)</i></p> <p><i>Increase</i>            Immune system of 0-4 yrs old more susceptible than 15+;            better diagnosis;            increase in pollutants / named;</p> <p><i>decrease</i>            better medication;            better understanding of the causes;            hypoallergenic products / named;            decrease in pollutants / government legislation;</p> <p>AVP; e.g. misdiagnosis, food allergy, vaccinations, more frequent GP visits for 0-4 years, ref to increased hygiene</p>	<p>1</p> <p>3 max</p> <p>3 max    <b>5 max</b></p>
(b)	<p>animal hairs / dander;            exercise;            pollen;            dust / dust mites;            lightning / thunder storms;            cold weather;            (air) pollution;            (passive) smoking;            chest infections;            AVP; e.g. contraction of smooth muscle in bronchi</p>	<p><b>2 max</b></p>
(c)	<p>mimic effects of adrenaline / noradrenaline;            relax smooth muscle in trachea / bronchioles;            opens up airways / AW;            reduce mucus blockage (by coughing); <i>R implication of drugs reducing mucus production</i>            reduce leaking capillaries;</p>	<p><i>R allow more air through and reduce inflammation</i>    <b>3 max</b></p>

**[Total: 11]**

Question	Expected Answers	Marks
6 (a)	X bronchiole; Y alveolus / alveoli; Z trachea / ring of cartilage; <i>R windpipe</i>	3
(b)	correct ref tar / heat; cilia paralysed / burnt; goblet cells; increased mucus; microbes accumulate; infection / pus; scar tissue; (chronic) inflammation;	4 max
(c)	subject breathes in and out through mouthpiece; upper box moves up <u>and down</u> ; causing pen to draw trace on kymograph / drum / AW; graph paper calibrated to measure volumes; measures tidal volume; measures vital capacity; reason for use of soda lime; e.g. shows levels of oxygen repeat; compare using healthy subject; other controls; AVP; e.g. health and hygiene, nose clip, don't watch apparatus, good soda lime	4 max

**[Total: 11]**





RECOGNISING ACHIEVEMENT

Mark Scheme 2857  
January 2005



Question	Expected Answers	Marks
2 (a)	response made by lymphocytes / specific immune system; B / T cells; to presence of <u>specific</u> , antigen / pathogen / non-self (human) cells; example of immune response; e.g. antibody production, T cell response	2 max
(b) (i)	secondary response is faster than primary one; rate of production of antibodies is faster in secondary response / AW; secondary response produces more antibodies than primary one; concentration of antibodies stays higher for longer; use of comparative figs;; e.g. give two examples	2 max
(b) (ii)	(vaccine) provokes (primary) immune response; vaccine contains antigens / weakened version of pathogen / named pathogen; B / T lymphocytes form memory cells; antibodies produced; (if same antigen is encountered) memory cells produce secondary response / AW; much faster than primary response; boosters mimic the secondary response; person unlikely to feel unwell / no symptoms; AVP; e.g. active immunity conferred	4 max
(c)	variable region contains antigen <u>binding site</u> binds with antigens; specific to the antigen; ref to amino acid sequence; hinge allows flexibility / AW; fits / wraps around antigen; constant regions attach to phagocyte; ref to labelling; AVP;	3 max

[Total: 11]

Question	Expected Answers	Marks
3 (a)	<ul style="list-style-type: none"> <li>1 balanced diet essential to provide all the nutritional needs of the baby / described;</li> <li>2 folic acid supplements (for first 3 months) to reduce risk of spinal defects / neural tube defects / named;</li> <li>3 no additional energy or other food components needed until the last three months of pregnancy;</li> <li>4 proteins needed for growth / cell division / to avoid IURG;</li> <li>5 protein needed for milk production (towards the end of pregnancy);</li> <li>6 carbohydrate / CHO / glucose needed for energy / respiration;</li> <li>7 lipids / fats / fatty acids needed for energy storage / respiratory substrate / respiration / AW;</li> <li>8 lipids needed for milk production (towards the end of pregnancy);</li> <li>9 iron needed for formation of (foetal) haemoglobin; A avoid anaemia R blood</li> <li>10 calcium needed for bones / teeth;</li> <li>11 calcium needed for milk production (towards the end of pregnancy);</li> <li>12 phosphorus needed for bones;</li> <li>13 vitamin A needed for retina / visual pigment / epithelia;</li> <li>14 vitamin D needed for formation of bones / teeth;</li> <li>15 vitamin D needed for milk production (towards the end of pregnancy);</li> <li>16 AVP; e.g. omega 3 fatty acids for brain / NS development</li> <li>17 AVP; e.g. ref to expected mass gain</li> </ul>	<b>6 max</b>
	<b>QWC – quality of spelling, punctuation and grammar.</b>	<b>1</b>
(b)	<ul style="list-style-type: none"> <li>cause foetal alcohol syndrome / FAS;</li> <li>mental retardation / described;</li> <li>reduced growth / lower birth weight;</li> <li>heart defects / named;</li> <li>poor muscle tone;</li> <li>short nose / cleft palate / receding chin;</li> <li>lack of swallow reflex;</li> <li>increased chance of miscarriage;</li> <li>AVP;</li> </ul>	<p>R behavioural problems because after birth</p> <p><b>5 max</b></p>
		<b>[Total: 12]</b>



Question	Expected Answers	Marks
4 (a)	substitution;	1 max
(b) (i)	valine / different amino acid; hydrophobic (R group); S cross bridge; (slight) distortion; R sickle shaped form long chains / polymers, crystallises, less soluble (at low ppO <sub>2</sub> );	1 max
(ii)	cells become rigid / AW; sickle-shaped / distorted cells; at low ppO <sub>2</sub> ; decreased surface area for diffusion; less oxygen carried; shorter life span of RBC;	2 max
(iii)	muscle cramps; blocked blood vessels; A clots, embolism damaged organs qualified; fatigue / breathlessness / fainting / dizziness / AW; rapid heart rate; jaundice; delayed growth; A stunted AVP; e.g. pain qualified, ref to exercise, shortened life expectancy	2 max

**[Total: 6]**

Question	Expected Answers	Marks
5 (a) (i)	<p>cells becoming specialised, for a particular function / named example of type of cell;            developing particular characteristics;      A example            certain genes being switched on / off;            increase in complexity;</p>	2 max
(ii)	<p>organ is a group of tissues;            working together to achieve a particular function;</p> <p>credit example; (for either)            AVP; e.g. correct definition of tissue / tissues are only made up of one type of cell</p> <p><i>max 1 if only one mentioned</i></p>	2 max
(b) (i)	C, D, A, B;	1 max
(ii)	<p>same number of chromosomes;            same genes / AW;  <u>genetically</u> identical / clone / same DNA;            DNA replicated;</p>	2 max
		<b>[Total: 7]</b>

Question	Expected Answers	Marks
6 (a)	HIV is the pathogen / virus; causes AIDS; R HIV becomes AIDS destroys immune system / AW; AIDS, is not a specific disease / is a syndrome; opportunistic; multiple infections / named;	3 max
(b)	(infected) blood transfusions; (infected) semen to blood / (infected) vaginal fluids / unprotected sex; R sexual fluids across placenta from (infected) mother; (infected) breast milk; sharing contaminated needles; R dirty needles AVP; e.g. from vaginal fluids during birth	3 max
(c)	antibiotics only effective against bacteria / HIV is a virus not a bacterium / ora;	1 max
(d) (i)	possible to be HIV positive and have no symptoms / dormant; UK has a fluctuating population / emigration / immigration; no routine testing for HIV / AW; HIV test not 100% accurate / AW; those at risk will not necessarily be tested; AVP; hard to keep track of contacts, hard to diagnose	2 max
(ii)	invasion of privacy / no freedom of choice; people may suffer prejudice / described; life insurance companies may refuse to insure HIV positive people; employment considerations for doctors / dentists with HIV; AVP; people may prefer not to know	2 max
		<b>[Total: 11]</b>





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RECOGNISING ACHIEVEMENT

Mark Scheme 2858  
January 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
	( )	= (underlining) key words which <u>must</u> be used to gain credit
	—	= error carried forward
	ecf	= alternative wording
	AW	= accept
	A	= or reverse argument
ora		

Question	Expected Answers	Marks
1 (a) (i)	a collection of / AW, cells; one or more types / AW; plus intracellular material; specialised to carry out a function / AW;	2 max
(ii)	R <u>ciliated</u> , epithelial; A <u>ciliated</u> columnar / pseudostratified S cartilage;	2 max
(iii)	secretes mucus; ref to stickiness; traps, dust / bacteria / pathogens / AW; protects, alveoli / gas exchange surface;	protects the lungs neutral 2 max
(b)	B	
	A	
	(AB) A and B	
	(O)	
	A and B	
	A A,B or AB or 'both' lower case for antibodies	
	R A,B and AB (row 4)	
	1 mark per correct row;;;;	4 max

- (c) diffusion;  
facilitated diffusion;  
osmosis;  
active transport;  
co-transport;  
  
R pinocytosis / phagocytosis 3 max
- (d) (i) (via) nuclear pores/described; 1  
(ii)
- |  |     |  |
|--|-----|--|
|  | RNA |  |
|  | DNA |  |
| has ribose                                 |     |  |
| has deoxyribose                            | ;   |  |
| has uracil                                 |     |  |
| does not have uracil                       | ;   |  |
| does not have thymine                      |     |  |
| has thymine                                | ;   |  |
| AVP; e.g. (mostly) single<br>stranded / AW |     |  |
| double stranded / AW                       | ;   |  |
- A letters U and T for uracil and thymine 2 max
- (e) (lowering pH) increases number of hydrogen ions;  
(hydrogen ions change) tertiary structure;  
bond(s) between R groups (broken);  
ref to ionic bonds;  
  
AVP; attach to NH<sub>2</sub> or form NH<sub>3</sub><sup>+</sup> 2 max
- (f) Golgi (apparatus / body); 1 max

- (g) prevents neuraminidase breaking down mucus / mucus not broken down;  
detail of inhibition; eg block the active site of neuraminidase  
(so) substrate / mucus, cannot bind / form enzyme substrate complex;  
(virus particles) trapped by mucus / ora;  
prevents neuraminidase breaking binding site / ora;  
virus remains attached to cell surface / ora;  
cannot infect other cells;  
more likely to be destroyed by immune system;  
detail of above; e.g. destroyed by phagocytes / antibodies  
AVP; e.g. reference to case study, evidence of research such as names of  
neuraminidase inhibitors

**4 max**

**[Total: 23]**



Question	Expected Answers	Marks
2 (a)	<p><i>Answers refer to prokaryotic cell</i></p> <p>no, nucleus / nuclear membrane;            naked DNA / no chromosomes / no histones;            circular DNA;            no membrane bound organelles / named organelles; R ref to chloroplasts            (presence of) cell wall;            (presence of) plasmids;            (presence of) mesosome;            qualified ref to ribosomes; e.g. 70s / smaller            (presence of) flagella;            AVP;;</p>	3 max
(b)	<p>HIV infection;            (being treated with) immunosuppressants;            AVP;; e.g. malnutrition, liver disease, having another infection, leukaemia,            R ref to age unless qualified</p>	2 max
(c)	<p>21/100 x 19 000;            3990;;</p>	2 max
(d)	<p><u>condensation</u> reaction;            removal of H and OH / described;            between carbon 1 and carbon 4 (of glucose);  <u>glycosidic</u> bond formed;            1,6 bond described;            AVP eg ref to branching;</p> <p><i>Accept fully annotated diagram if correct</i></p>	4 max
(e)	<p>ref to specificity;            complementary shapes / described; R same shape            (of) variable region;            binds to antigen / AW;            (different antibody) would not bind / recognise;            antibody has different shape;            AVP e.g. ref to memory cells, antigen differences are genetic idea</p>	3 max
(f)	<p>antibodies are proteins / implied;            AVP; e.g. antibodies (also) found in plasma</p>	1 max

continued

**Question 2 Expected Answers**

cont'd

(g)

*Ignore references to virus*

- 1 (in) droplets / described;
- 2 coughed / sneezed / AW, by infected person / AW;
- 3 ref to symptomless carriers;
- 4 inhaled;
- 5 by susceptible person;
- 6 ref to avoid overcrowding;
- 7 ref to improve ventilation;
- 8 ref to personal hygiene; e.g. hand washing
- 9 ref to isolation (of suspected cases);
- 10 ref to cleaning / use of disinfectants;
- 11 ref to laundry;
- 12 ref to spitting ban;
- 13 ref to correct use of antibiotics;
- 14 ref to screening;
- 15 ref to infected blood;
- 16 ref to barrier nursing;
- 17 ref warnings to (potentially) ill visitors;
- 18 AVP; e.g. ref to vaccination
- 19 AVP; e.g. further detail of 6 – 16

**7max****[Total: 22]**



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RECOGNISING ACHIEVEMENT

Mark Scheme 2866  
January 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 <u>must</u> be used to gain credit
	—	= error carried forward
	ecf	= alternative wording
	AW	= accept
	A	= reject
	R	= or reverse argument
ora		

Question	Expected Answers	Marks
1 (a)	parasympathetic nervous system <u>and</u> sympathetic nervous system;	1
(b) (i)	A dendrite / dendron; B Node of Ranvier; R axon C Schwann cell / myelin sheath;	3
(ii)	cell body / centron, is at one end / AW; A nucleus at one end	1
(iii)	transmitter substance contained in / released by, <u>axon terminal</u> / <u>synaptic knob</u> ; arrival of action potential; neurotransmitter released from / vesicles fuse with, presynaptic membrane; into synaptic cleft; receptors on post synaptic membrane / ora; R on one side trigger action potential; AVP; ref to hyperpolarisation, refractive period, described	3 max
(c) (i)	no (nerve) impulse; from named nervous tissue; e.g. vagus, SAN,AVN, bundle of His, Purkyne blood supply interrupted; to <u>coronary arteries</u> ; no oxygen / glucose; heart muscle dies / heart attack; R cardiac arrest <u>myocardial infarction</u> ; no blood to organs / no blood pumped around body / organ failure / named; AVP; e.g. ref to respiration	4 max
(ii)	electrocardiogram / ECG; electrodes attached to arms / legs / limb leads; electrodes attached to chest; 6 positions; patient must lie still; 12 different tracings produced; comparison of the 12 pathways; AVP; e.g. produces a graph, graph drawn R refs to interpretation of result	3 max

[Total: 15]

Question	Expected Answers	Marks
2 (a) (i)	interruption of natural succession / described; so <u>climax</u> community / vegetation, is not reached / different <u>climax</u> reached; reaches a <u>plagioclimax</u> ; AVP; <i>if e.g. used don't A same point in (ii)</i>	2 max
(ii)	(heavy) grazing; mowing / cutting, grassland / AW; burning; deposition of cowpats; deforestation; hedge control / removal / AW; AVP;; e.g. herbicides qualified, ploughing, pig farming, crops instead of grassland	2 max
(b) 1	<u>total</u> food production increases;	
2	total food production falls 1978/9 / food production per head falls 1976/7;	
3	food production <u>per head</u> increases more slowly;	
4	total food production less than food production per head up to 1973/4 / ora;	
5	figs in support, both axes;	2 max
6	because the human population increases / ora;	
7	idea of demand outstripping supply;	
8	need to control population / birth control / contraception / AW;	
9	will result in food shortages / famine;	
10	AVP; e.g. uneven distribution of food between countries, more than enough food to feed everyone up to 1973/4	3 max
(c)	<i>Mark points in any section. Max 5 if both sections not covered</i>	
<i>biological</i>	B1 lose natural checks / balances / AW, on population; B2 natural selection does not operate; B3 may breed in harmful alleles / increase genetic load / AW; B4 exceed carrying capacity of the environment; B5 deplete (finite) resources; B6 increase toxic waste / pollution; B7 AVP; e.g. multiple births, use after chemotherapy, drugs B8 AVP; may be toxic, may have unexpected traits	
<i>ethical</i>	E9 women have a right to procreate; E10 not right to interfere with nature / AW; E11 religious objection; R 'playing God' E12 pressure on medical resources / not a priority / AW; E13 traumatic / disappointing if not successful; E14 fate of frozen embryos; E15 AVP; e.g. cost of treatment to parent, cost to medical E16 AVP; profession, post menopausal women, identity of donors	
		6 max
	<b>QWC - for the quality of spelling, punctuation and grammar;</b>	1
		[Total: 14]

Question	Expected Answers	Marks
3 (a) (i)	oxygen binds to the haem groups; R iron first, oxygen molecule, binds slowly / harder to bind / AW; distorts shape of molecule / allosteric; easier for next oxygen to bind / next oxygen molecule, binds faster; curve therefore steep in middle; AVP; e.g. effect diffusion gradient on binding of fourth oxygen molecule	3 max
(ii)	as the partial pressure of carbon dioxide increases, the saturation of Hb with oxygen decreases / desaturation increases; curve shifts to the right; figs using both axes to illustrate; Bohr effect / shift;	<i>only award this mark once in either (ii), (iii) or (iv)</i> 2 max
(iii)	increased CO <sub>2</sub> levels release H <sup>+</sup> ; decreases pH (in the plasma); this would change the (3D) structure of the Hb / decrease enzyme action / e.g. of change; Hb acts as buffer / helps to keep pH constant; binds to / mops up H <sup>+</sup> ; forms haemoglobinic acid / HHb; causes the release of the oxygen by the Hb / lowers affinity for oxygen / AW; Bohr effect / shift;	<i>if not awarded in (ii)</i> 4 max
(iv)	during exercise rate of respiration increases; as demand for oxygen increases; more released (from Hb) AW; Bohr effect / shift;	<i>if not awarded in (ii) or (iii)</i> 2 max
(b)	1 red fibres contain myoglobin; 2 contains more mitochondria; 3 slow twitch fibres; 4 myoglobin has a higher affinity for oxygen (than haemoglobin); 5 will only release oxygen, when the partial pressure of oxygen is very low / AW; 6 therefore myoglobin provides a backup / reserve / store / supply, of oxygen; 7 delaying the onset of anaerobic respiration / ora; 8 therefore more <u>ATP</u> available for a longer period (for muscle contraction); R energy 9 less lactate / cramp / muscle fatigue; 10 will load up with oxygen, from haemoglobin (when it is again available) / AW;	4 max

[Total: 15]

Question	Expected Answers	Marks
4 (a)	<i>choice of volunteers</i>	
	<p>1 large sample / at least 10;            2 check for, asthma / heart condition / diabetes / physical handicap;            3 same sex / age;            4 same BMI; A same height and mass / weight R mass alone            5 similar fitness / AW;            6 similar diet prior to experiment / diet is only variable during the experiment;            7 AVP; e.g. idea of similar aerobic threshold</p>	
	<i>description and explanation of results</i>	
	<p>8 glycogen stores are highest on high CHO diet / ora;            9 after exercise, high CHO diet has highest glycogen concentration / ora;            10 longest endurance / cycle longer, on high CHO / highest glycogen concentration /ora;            11 CHO converted to glycogen / stored as glycogen;            12 in muscle;            13 glycogen is hydrolysed / AW; R broken down            14 to glucose;            15 oxidised;            16 in respiration;            17 detail; ref to glycolysis, Krebs cycle, etc            18 to release energy;            19 as ATP;            20 needed for muscle contraction;            21 detail of involvement in power stroke / movement of actin / release of myosin from actin;            22 myosin head is ATPase;            23 glycogen depleted after exercise / used during exercise;            24 mixed diet / low CHO, not energy rich CHO / AW;            25 lipid harder to metabolise / AW;            26 use of comparative figs to illustrate;; <i>units at least once</i>            28 AVP;</p>	<b>9 max</b>
	<b>QWC - for the quality of use and organisation of scientific terms;</b>	<b>1</b>
	<i>bold indicates at least 3 terms required for QWC mark</i>	

continued

Question 4 cont'd	Expected Answers	
(b)	(i) glucose dissolves in water in gut; reduces the water potential; water flows out of blood / tissue lining gut, into the lumen of the gut / AW; down water potential gradient; by osmosis; AVP;	R cells dehydrate  <b>3 max</b>
	(ii) use an <u>isotonic</u> drink / drink with same concentration as body fluids;	<b>1</b>
(c)	<u>saturated fat</u> ; increases CHD / MI / heart attack / death of heart muscle / stroke; detail; e.g. builds up on artery <u>wall</u> hard to digest; may lead to obesity; R overweight AVP; e.g. atherosclerosis, atheroma, hypertension, high BP, blood clotting, embolism, high <u>blood cholesterol</u>	<b>2 max</b>
		<b>[Total: 16]</b>



Question	Expected Answers	Marks
5 (a)	<p><i>1 mark for precaution and 1 mark for detail</i></p> <p>check whether immunity to rubella is present; check for <u>antibodies</u> (for rubella); rubella harms foetus (in first trimester) / specific e.g.;</p> <p>increase folic acid intake; guards against neural tube defects; spina bifida / hydrocephalus / specific e.g.;</p> <p>AVP;; e.g. STD tests named + detail, change in life-style e.g. stop smoking + reason, e.g. of healthy diet + need</p>	<b>4 max</b>
(b)	<p><i>mark points in either section (i) or (ii)</i></p> <p>(i)</p> <p>1 <u>specific</u> to HCG; 2 these are attached to a coloured (latex) particle; 3 (when urine sample introduced into test kit) antibodies move / are mobile; 4 forms mAb HCG complex / AW; 5 HCG is carried with antibodies, to a line of (immobile) mAb (specific) antibodies; 6 complex binds with these; 7 to produce a coloured line / AW; 8 this indicates conception has occurred / AW; 9 any uncombined antibodies continue to move; 10 to second line mAb (specific) antibodies; 11 (form second coloured line) to show that test is working; 12 AVP; e.g. gives a positive as early as first day of missed period, HCG secreted in the urine, the pad of the kit is wet with urine</p> <p>(ii)</p> <p>13 HCG is a peptide; A protein 14 acts as an antigen; 15 (if antibodies cloned) <u>all</u> same / AW;</p>	<b>7 max</b>
	<p>(iii) corpus luteum secretes progesterone; maintains, endometrium / lining of uterus; R wall of uterus inhibits, FSH / LH; prevents ovulation / menstruation / miscarriage; AVP; ref to placenta taking over</p>	<b>2 max</b>
(c)	<p>(i) <i>mark (i) and (ii) together for 4 max. 3 max if only one answered</i> stimulates, growth of mammary glands / breasts; prepares for / stimulates / aids, milk production / lactation; R produces milk / ref' to glandular / alveolar cells; secretion of milk in (i) inhibited by, oestrogen / progesterone;</p> <p>(ii) controls milk production / lactation; R releases milk increased by suckling; increases, as oestrogen / progesterone level falls / when inhibition removed; promotes bonding;</p>	<b>4 max</b>

**[Total: 17]**

Question	Expected Answers	Marks
6 (a)	(i) arrow from top of page towards bottom;	1
	(ii) rhodopsin is a photosensitive pigment / detects light / converts light energy into chemical energy; light splits rhodopsin; into opsin <u>and</u> retinal; retinal changes shape; from <i>cis</i> to <i>trans</i> ; no longer fits binding site of opsin / separates from opsin; AVP; e.g. opsin is an enzyme, ref hyperpolarisation	3 max
	(iii) regeneration of rhodopsin requires energy / AW; energy provided by ATP; ATP produced during respiration; (energy needed for) for sodium - potassium / cation pump / ora; for protein synthesis; AVP; e.g. no hyperpolarisation / impulse / action potential	2 max
(b)	rod cone  one type three types;  long / thin shorter / fatter;  pigment is rhodopsin three different pigments / iodopsin;  more pigment less pigment;  discs all separate from plasma membrane discs still connected to plasma membrane;  more sensitive (than cones) / single photon less sensitive (than rods);  for night vision / dim light for day vision / bright light;  poorer resolution / visual acuity than cones better resolution / visual acuity than rods;  respond slowly respond faster;  give black and white / grey vision give colour vision;  AVP e.g. more vesicles, scattered	3 max

AVP; e.g. less vesicles, in fovea

- (c) forms two synapses ; with ganglion cell and, rods / cones;  
AVP; **1 max**
- (d) several rods supply each bipolar neurone / ganglion cell / AW;  
therefore more stimulation of each bipolar neurone / ganglion cell;  
less neurotransmitter;  
one photon of light, enough to produce a response / stimulus;
- each cone synapses with one bipolar neurone / ganglion cell;  
each cone therefore produces separate impulse / AW;
- idea of, response is the average of several rods / separate image per cone; **3 max**

**[Total: 13]**





## REPORT ON THE UNITS January 2005

### Chief Examiner's Comments

After the very successful session in summer 2004 for OCR's new specification in Human Biology, the examiners had anticipated relatively few entries in January and were consequently pleased and quite surprised at the large entry for 2856. Approximately 10% of the candidates were retaking the examination and of the remainder, some centres were sensibly using the paper as an external mock examination, but there were also some excellent papers from candidates who will be pleased with the result.

The other AS modules were entered by a high proportion of candidates who were retaking the examination. A general improvement in their performance was noted. The Examiners were puzzled by the small number of candidates who were entering 2858/01 for the first time. In theory, this paper may only be taken with coursework carried forward from the previous summer or taken or entered at the same time during the June session only. These candidates set themselves a hard task to prepare themselves adequately for the paper. It is intended that this pre-release paper should give the candidates ample opportunity to learn thoroughly the learning outcomes from 2856 and 2857 that may be associated with the questions. A good standard can only be gained by a thorough knowledge and understanding of the Advanced Subsidiary programme of study.

Similarly, candidates entering for 2866 have done well to prepare themselves for this full A2 module which contains synoptic questions based on the Advanced Subsidiary specification. It takes a thorough knowledge of the specification and a mature understanding of the content to spot and fully answer a synoptic question. The Examiners saw some good A2 scripts and these candidates are to be congratulated, but there was also evidence in many papers of lack of practice in handling some of the A2 skills, e.g. more complex data questions and synoptic links.

It was pleasing to see that many candidates are maximising their marks on data questions by illustrating their answers with accurate figures quoted from the data. Where graphs are described, both axes should be quoted with appropriate units. For both graphs and tables, comparative figures frequently score marks, e.g. 2857 Q 2b and 2866 Q 2b 3a(ii) and 4a. Where graphical data are presented on a complete grid, it is expected that the figures quoted will show a greater accuracy than those from an ungridded graph, where a figure range may be allowed. There was no evidence in this session that candidates had presented themselves for the examination without a ruler and calculator. It was pleasing to see that a number of candidates had drawn intercepts on graphical figures to obtain an accurate reading.

Those terms which are printed in bold in the specification indicate that a definition is required. Candidates will be asked for these definitions, and a full explanation occasionally, on examination papers.

The Examiners are pleased with the enthusiastic reception for this specification and the obvious interest, backed up by the thorough preparation that is indicated by the candidates' work in many instances. This is an exciting specification with ideas and techniques that will appeal to the majority of students interested in careers involving interaction with others. However, as for any specification with 'Biology' in its title, it includes all the Biology criteria within the learning outcomes, as specified by QCA. It is therefore essential that the candidates' interest in the context should not prevent them learning the basic biological principles that underpin this context. It should, in theory, be possible for a well-prepared candidate to do equally well on a Biology module of equivalent standard and content.

There are several learning outcomes throughout the specification that refer to ethical issues and a separate section on ethics may be found in the specification on pages 15 and 78. However, the rationale for the specification is based on 'real world' contexts in situations specifically applied to humans. It is therefore designed to encourage a thoughtful, caring approach to many aspects of human activity that inevitably involve basic ethical principles. The content of the specification allows time for the discussion of such issues and candidates should be encouraged to investigate issues throughout the specification themselves with the intention of taking part in class discussion. Examination questions on such issues are likely to be found on any topic within the specification.

### Teaching tip

As with many skills, it is important to practise answers to ethical questions. Questions are rarely accepted as answers to such questions. Examiners look for clearly reasoned statements. It may be helpful to consult colleagues in departments such as History or Religious Education where candidates are familiar with discussions in preparation for examinations. The length of the specification should allow time for class discussion and exploration of ethical issues relevant to this specification.

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 and

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

It is hoped that the accompanying textbook for A2 will be published in April. At present the full content of the A2 textbook, in draft form, may be viewed on the CUP web site [www.cambridge.org/humanbiology](http://www.cambridge.org/humanbiology)

These textbooks are an excellent teaching aid for both content and skills but it is important to remember that they are **not** a substitute for the specification. It is hoped that candidates will consult a wide range of resources during their course. There is ample opportunity to do so in preparation for the AS Case Studies paper and for the Extended Investigation at A2.

The A2 coursework, which takes the form of a single Extended Investigation will be examined for the first time in the June 2005 session. The Examiners are looking forward to seeing the results of this opportunity for candidates to pursue particular interests in depth, as a way of fulfilling the coursework criteria.

OCR would like to assure teachers that they are more than happy to help with queries. A programme of INSET sessions for Human Biology is advertised in OCR's Science INSET booklet, which should be sent out to Centres in June. Queries may also be directed to the Subject Officer for Human Biology, Wendy Thornhill at [Thornhill.W@UCLES.org.uk](mailto:Thornhill.W@UCLES.org.uk) or the Chief Examiner, Anne Wilson at [anne@ginadoq.demon.co.uk](mailto:anne@ginadoq.demon.co.uk) Teachers are also advised to use the references and website resources listed from pages 56-58 of the specification.

If there is any doubt about the suitability of a topic, we strongly advise Centres to use OCR's free coursework consultancy service. Centres can submit possible topics and/or individualised mark schemes, which will be reviewed by a senior coursework Moderator and a report written that will give advice and guidance. Please contact the subject officer at OCR if you would like to use this service.

## 2856: Blood, Circulation and Gaseous Exchange

### General Comments

Generally, there seemed to be an improvement in the quality of the candidates' responses in this session, compared with those on the June 2004 paper. The entry includes a high proportion of weaker candidates, but it is clear that both teachers and candidates are getting to grips with the teaching material and the textbook has obviously helped. It was apparent that many candidates had learnt key concepts directly from the book. Future examination papers and mark schemes will continue to be linked closely with this teaching aid but it is important to note that the text book is not a substitute for the specification. More candidates during this session appeared to score slightly higher on the extended answer question and this was encouraging.

### Comments on Individual Questions

Q.1 This question achieved slightly lower than expected marks. The first question on the examination paper usually includes a number of marks earned by straightforward recall of factual material. In many cases candidates did not appear to have the required information.

- (a) It was disappointing that more candidates could not achieve full marks on simple recall due to lack of knowledge of membrane structure. About half, or just over, got full marks for this section. A few candidates named simple organelles eg endoplasmic reticulum and ribosomes, showing that they had not read the stem of the question properly, which simply asked for the identity of two structural components of the membrane.

#### Teaching tip

Ask the candidates to make models of membranes using plasticene and matchsticks. This makes it much easier to demonstrate passage of materials through membranes.

- (b) A considerable number of candidates did not know how to do the conversion of the figures to produce the answer in appropriate units. Of those who knew the basic method, some still failed to score both marks mainly due to inaccurate measurement of X to Y or by finishing up with either the wrong units or the decimal point in the wrong place. The mark was given if the answer was calculated in micrometres as long as the units given on the answer line were also changed.

#### Teaching tip

Encourage candidates to learn general formulae eg % increase or decrease in mass or length =  $\frac{\text{change}}{\text{original}} \times 100$ .

- (c) Few achieved full marks on part (c). Most candidates who achieved any marks got them for general features which could apply to any membrane i.e. "partially/semi permeable" and "separate the contents from the outside". It was those who could name roles specific to the leucocyte who tended to achieve full marks. (Learning outcome 5.1.1.1 e).



- Q.2 Overall, part (a) was answered much better than (b) in which there were some fundamental misconceptions. There were a reasonable number of good quality answers.
- (a) There were some common errors in this part. Many candidates did not know the life span of erythrocytes (many put 2 months). Few knew where they were broken down, with many suggesting that it was in the bone marrow or blood rather than the spleen or the liver. A large number of candidates could only suggest 'many' rather than four polypeptide chains. Most knew that haemoglobin contains iron and that it combines with oxygen forming oxyhaemoglobin.
- (b)(i) Answers to this question were very disappointing. Most candidates answered by describing isotonic drinks in relation to blood, rather than defining the term 'isotonic' itself, whilst others clearly had no idea.
- (ii) This question was answered better than part (i). Most candidates knew at least that isotonic drinks replace water and ions. Few could make references to osmosis. A common misconception was that isotonic drinks contain glucose for energy whereas these are 'energy drinks' first and not specifically isotonic.

**Teaching tip**

Ask candidates as a homework task, to analyse the composition of energy and isotonic drinks (by using ingredient labels) in relation to the composition of plasma.

- Q.3 Candidates generally performed well on this question relative to performance overall. Several candidates did not attempt the question, but if it was attempted, it was relatively easy to pick up 3-4 marks. The generous nature of the mark scheme in terms of both techniques and social, ethical and economic issues involved in surgery meant that many candidates gained full marks. Many were able to pick up marks by merely mentioning heart bypass, angioplasty and heart transplant without any detail. Some candidates veered off the point and produced lengthy descriptions of plaque formation etc. Many attempted the social, ethical and economic part of the question and gained marks by indicating the high cost and religious objection. Overall, well answered and encouraging for an extended answer question with ample opportunity to score the QWC mark for specialist terms. The QWC mark was credited for three specialist terms from the coronary artery, bypass, angioplasty, catheter, stent, athrectomy, and immunosuppressant. All terms had to be in the correct context.
- Q.4 This was fairly well answered as was expected, being mostly straight recall. Part (d) was the exception and candidates struggled with this question that turned out to be a good discriminator for the upper end of the ability range.
- (a)(i)(ii)(iii) This was simple recall and many had obviously learned the terms whilst a few had not. Prothrombin was a common wrong response to (i).

- (b) Most mentioned the blockage of the circulation. Some candidates referred to stopping blood flow to the lungs or brain but did not link this to the descriptive term of pulmonary embolism or stroke. A few candidates seemed confused about exactly what gets blocked in the heart. Many thought it was the chambers which became blocked, rather than the blood supply in the coronary arteries feeding the heart muscle.
- (c) This question was quite well answered in terms of general reference to the circulation. Many candidates attempted an answer by indicating what happens when sitting down motionless. No candidate mentioned that the platelets were less sticky when a person is moving around. Most candidates managed to score at least two here.
- (d) This question, that in essence asked for a description of the mechanisms of enzyme inhibition (learning outcome 5.1.1.4 d), was badly answered and many candidates dwelt on the clot busting drugs rather than how they worked as inhibitors. When inhibition was mentioned, the majority of answers did not distinguish between competitive and non-competitive inhibition.

**Teaching tip**

Encourage candidates to use the BUPA website ([www.bupa.co.uk](http://www.bupa.co.uk)) which has good clear explanations of clotting / DVT and treatment.

**Q.5** The majority of candidates scored over half marks on this question which was accessible to the whole ability range.

- (a)(i) This was badly answered and responses such as “to make a nice graph” were common. This is a basic concept when looking at data handling questions, especially with respect to population numbers and will no doubt come up again.
- (ii) Most candidates were able to gain three for the description although a common mistake was to describe in detail the intricacies of each line rather than the trends. Few candidates were able to quote figures correctly (i.e. 60 per 100 000 rather than 60) and from both axes. Few gained full marks for the explanation. A common misconception was that pregnant mothers who smoked would cause asthma in their babies.

**Teaching tip**

Ask candidates to analyse the ‘shape’ of various graphs and then predict how many marks there would be for the question. Mark allocation and the available space for the answer are both important indicators of the depth of answer and number of facts required.

- (b) Usually well answered by a range of causes of asthma from a long list.
- (c) Very few candidates scored more than 2 marks here. Many managed to mention that beta agonists opening up airways. Candidates incorrectly wrote about reduction of inflammation i.e. confusing it with anti-inflammatory drugs

such as inhaled corticosteroids. Some thought that beta agonists destroyed mucus whilst others thought that they inhibit or slow mucus production. Candidates did not always make it clear that beta agonists act on the smooth muscle of the airways.

### Teaching tip

Information on asthma 'relievers' (beta agonists) and 'preventers' (corticosteroids) may be obtained from the BBC web site:

[http://www.bbc.co.uk/health/conditions/asthma/treatment\\_index.shtml#main\\_treatments](http://www.bbc.co.uk/health/conditions/asthma/treatment_index.shtml#main_treatments)

- Q.6 Some good answers were seen for this question, although some candidates found it hard to organise their thoughts on the extended answer questions.
- (a) This was surprisingly poorly answered, particularly as it is very close to GCSE standard. Candidates seemed to muddle up bronchioles and alveoli when matching them with the letters. Candidates should be reminded that the header to this section of the specification (5.1.3) indicates that a knowledge of the Key Stage 4 programme of study Sc2, 2d, 2m and 2p is a prerequisite for an understanding of this section.
  - (b) This question was generally well answered. Common mistakes were to discuss at length cancer or emphysema, writing in depth about phagocytes and elastase rather than directly answering the question. References to killing cilia were frequent and should be discouraged.
  - (c) Most candidates were able to gain at least two marks here. Few wrote about the calibration of the graph paper, health and safety comments, or technique to use the apparatus eg nose clip / look away. One common misconception was that some thought that the spirometer measured just vital capacity or was some sort of peak flow meter. However, the clear diagram as stimulus material allowed most candidates to access some marks. There was a clear distinction between those candidates who had used or seen this apparatus used and those whose knowledge was purely theoretical.

## 2857: Growth, Development and Disease

### General Comments

Advanced Subsidiary papers include many questions that require straightforward recall. It is therefore essential that candidates thoroughly learn the factual detail for the topics in the specification.

Human Biology for AS Mary Jones, Geoff Jones CUP 2004 ISBN 0 521 54891 8 is the approved text book for this specification. Whilst the textbook follows the specification closely it is not a substitute for the specification and it is hoped that candidates will read and investigate further, both independently and by discussion with their teachers and each other, the topics covered for this Module.

The availability of the textbook clearly helped both teachers and candidates to access the more specialist topics covered by the learning outcomes of this Module. There were fewer blank spaces on the examination papers this year and candidates seemed able to score marks consistently across all six questions.

### Comments on Individual Questions

- Q.1 This was a straightforward factual question and those candidates with a thorough recall of the facts scored well and produced some detailed and full answers. However, many answers were confused or made only vague references to the techniques.
- (a)(i) It was hoped that candidates would be able to describe how thermography produced a heat map of the breast. A number of candidates thought that the technique used X-rays rather than heat sensitive film and there was some confusion as to whether heat was produced or detected by the apparatus. There was however a number of correct references to infrared and the relationship between the temperature in the breast and the colour produced. Those candidates with a thorough understanding scored marks for references to the release of heat from blood vessels supplying the cancer.
- (ii) There was some confusion on the limitations of thermography as a diagnostic tool. Many candidates did not appreciate that the apparatus measures areas of high metabolic activity and therefore activities such as infection, pregnancy or muscle contraction could give a misleading result. Thermography does not specifically diagnose cancers and is therefore not a conclusive diagnostic tool.
- (b) In general candidates did well on this question. The characteristic feature was the poor spelling of the techniques. The Examiners were happy to credit the mark if the spelling of the technique was recognisable or correct phonetically but some were either left blank or were so inaccurate that a mark could not be given. A number of candidates did not observe that the question asked for **surgical** methods and produced detailed descriptions of non-surgical techniques such as chemotherapy and radiotherapy that scored no marks. References to the removal of the lymph glands needed to be qualified to gain a mark eg by adding 'to check that the cancer had not spread' or 'after testing for spread'.

- (c)(i) Answers to this section indicated a lack of practice in picking out trends. Poor use of language lost marks as this frequently resulted in a failure to state the trend clearly eg in terms of the overall trend for both groups; the trend for prevalence (rather than incidence) and the trend for rate in each group. As is always the case, marks were given for accurate figures that illustrated the trend. This invariably requires candidates to use comparative figures in their answer. Marks were also given for picking out significant points in the data.

#### Teaching tip

Data interpretation is a skill that must be learnt. This skill may be practised by the use of data from web sites: e.g. For cancer <http://www.cancerbacup.org.uk/Home> or more generally the Health protection Agency <http://www.hpa.org.uk/>.

Past papers from the Biology specification particularly Module 2802 Human Health and Disease are also a useful source of relevant data.

- (ii) Few candidates experienced difficulty with this simple calculation. A single mark was given if the candidate had used the correct method but, for example, had got the decimal point in the wrong place.

Q.2 Candidates find the immune system one of the more difficult sections of the specification. Some candidates undoubtedly found this question difficult. An attempt was made to provide accessible marks at the lower end of the ability range but the bulk of the question was targeted at the more able candidates.

- (a) Candidates should be aware that any term highlighted in bold in the specification must be accurately defined and such a definition is likely to be tested. Most candidates managed to score one mark for antibody production or another appropriate example of a response. However, a considerable number of candidates did not appreciate that the immune response is confined to the cells of the **specific** immune system. Therefore in some cases long descriptions of phagocytosis could not be credited. For those candidates with a good understanding of the process there was no difficulty in scoring two marks.
- (b)(i) Most candidates scored at least one mark for this question for the observation that the secondary response was faster. A significant number however thought that the numbers 1 and 2 on the answer lines were a reference to the primary and secondary response. These numbers are given to help the candidate when two answers are required and normally the first two answers only are marked. The Examiners decided to mark whatever was given to give the candidates the benefit of any doubt in this case. Few candidates commented on the differences in the number of antibodies **and** the rate of production of antibodies. Comparative figures to illustrate the point were also credited.

- (ii) There was a generous marking scheme for this four-mark question and the examiners were pleased to see some full and accurate answers. These were however in the minority. A few candidates are confused about which is the antibody and which the antigen. The majority knew that antibodies were produced and also memory cells but few indicated that the B / T cells produce the memory cells, for the second mark. Many candidates stated that the secondary response was fast but the marking point required the term 'faster'. Surprisingly few noted that the secondary response does not produce symptoms. Some candidates scored an AVP for noting that the vaccine produced an active immunity. The term vaccine should only be applied to active immunity and therefore references to passive 'vaccine' were not credited. References to 'small doses' of vaccine or the pathogen were not acceptable. The term required on the mark scheme was 'weakened' or 'attenuated'.
- (c) A number of candidates did not attempt this question and of those who did, a number appeared to have little understanding of the adaptation of the antibody to its function in spite of the clear labelled diagram to give the candidates some help. There were few references to the 'binding site' on the variable region. Many candidates stated that 'the variable region changes for each antigen / bacterium etc'. However, this is ambiguous and marks were lost if the answer implied that each variable region will change. Use of the word 'specific' avoids this difficulty. The function of the hinge in allowing flexibility to wrap around the antigen was worth two marks but many candidates only mentioned the movement or flexibility of the hinge. Only a handful of candidates were able to tell the Examiners that the constant region is used to label pathogens or attach to the phagocyte. References such as 'holding the structure' or stabilising the antibody' were not credited.

**Q.3** The Examiners had thought that this would be a high scoring question as it was largely recall and targeted at the middle to bottom of the ability range. They were disappointed to discover that many candidates were very vague on the facts.

- (a) The QWC question had a generous mark scheme and the majority of candidates scored the mark for a legible answer with accurate spelling, punctuation and grammar. However, the candidates were asked to state **and** explain the nutritional requirements, and therefore those candidates who simply listed the dietary requirements without explaining their uses, did not score the marks. The first marking point required the candidate to explain that the diet should be balanced, or to describe a balanced diet throughout the answer. However, although many candidates were able to do this, a number then suggested that the mother should 'eat for two' or take supplements. With the exception of folic acid, this is not the case under normal circumstances and so the mark for the description of a balanced diet was not awarded. The candidates who produced a list of the requirements, each qualified by the reason for their requirement, scored well over maximum marks with comparative ease. It was pleasing to see some detailed answers which included the optimum mass increase for pregnant women, the timing of the need for particular nutrients or that high doses of vitamin A were toxic. However, a significant number of candidates only mentioned folic acid and calcium by name and made no reference to carbohydrate, protein and lipid at all. To score most of the marks, specific vitamins and mineral salts should have been referred to in addition to carbohydrate, protein and lipid. A significant number of candidates went off track by detailing the need for the mother to give up smoking and avoid alcohol. This question indicates clearly

the need to back up practical suggestions, in this case on diet, with sound biological facts as to why the nutrients are needed.

**Teaching tip**

This is an ideal topic for independent learning. There is a vast amount of information on the internet and in the media, including popular magazines, on the dietary requirements for pregnant women. A simple homework exercise would require the candidates to construct a table with two columns, one for the nutrient and one for its use. Care should be taken to distinguish between anecdotal and sound scientific evaluation of the information.

- (b) Some candidates were able to list in detail the effects of alcohol on the foetus and most were familiar with the term 'foetal alcohol syndrome'. However, there were a large number of answers that simply stated that alcohol 'affects' the brain, heart etc. It is not for the Examiners to decide for the candidate what the effect might be. Most candidates knew that growth was reduced. Few candidates referred to the lack or reduction of the swallowing reflex or detailed the changes that may occur in the face. Many incorrectly linked alcohol consumption by the mother to genetic diseases in the foetus.

**Teaching tip:** This is an ideal topic for independent learning. There is a vast amount of information on the Internet, and in the media, including popular magazines, on the dietary requirements for pregnant women. A simple homework exercise would require the candidates to construct a table with two columns, one for the nutrient and the other for its use.

Q.4 Many candidates scored well on this question, which was quite straightforward, but a number did so by rewriting material two or three times in the different sections of the question. Examiners gave credit where they could, but often 'correct answers' appeared in the wrong sections. It is important that candidates read all sub-parts of a question before starting on their answer in order to avoid repetition of material and loss of marks.

- (a) There were a surprising number of wrong answers to this simple question. Many candidates thought that Fig. 4.1 showed a 'chromosome mutation'.
- (b)(i) Few candidates referred to valine or another amino acid. Vague references to change in shape were not credited, as the distortion is only slight. There were some good answers which referred to the hydrophobic nature of the substituted amino acid and the tendency of the haemoglobin to crystallise at low oxygen concentration.
- (ii) Most candidates scored two marks here by describing the effect on oxygen transport of the distorted red blood cells.
- (iii) Many candidates scored two marks here for the mention of blocked blood vessels, breathlessness or muscle cramps and details of the painful symptoms of a sickle cell crisis.

- Q.5 Many candidates made heavy going of this question, with the relationship between tissues and organs often poorly understood and articulated. Candidates are advised to pay close attention to the number of marks awarded for each section of a question in order to gauge the number of separate points they must make.
- (a) Most candidates failed to score more than one mark for the definition of the term *cell differentiation*. The idea that cells are specialised for a particular **function** was often not stated. Better candidates did refer to the idea of genes being switched on / off or indicated that the cell was increasing in complexity. The word 'relationship' in the stem of the second part of this question appeared to cause problems for some candidates (despite appearing in the relevant learning outcome 5.2.1.1f). Many weaker candidates appear to think tissues 'line' and 'protect' organs rather than being a part of their structure. It was not difficult for better candidates to score full marks on this sub-section.
- (b) The examiners were very pleased that the majority of the candidates were able to sequence the stages of mitosis accurately in the first section of this question. Unfortunately, most failed to score two marks for the second part as they limited their answer to just one marking point. Many thought that the chromosome number halved ie interpreted 'daughter' literally. The Examiners were hoping that candidates would identify this question as asking for the effect of mitosis on the daughter cells produced ie. replication of DNA, genetically identical, the same chromosome number and the same genes.
- Q.6 Most candidates picked up some marks on this question, but the Examiners were surprised (and concerned) by the number of candidates who lacked basic knowledge about either the relationship between HIV and AIDS or the ways in which HIV may be transmitted. Candidates are reminded that needles do not become infected, but may become contaminated with infected blood. Once again, candidates are advised to look at the number of marks available for each part question; many lost marks on the last two sections as only one point was made for each.
- (a) Some candidates think that HIV and AIDS are separate viruses! Many spelt AIDS in lower case, which indicates a poor understanding. Surprisingly few used the word 'syndrome' when describing AIDS, or referred to opportunistic infections.
- (b) Descriptions of transmission were generally poorly done with few candidates qualifying the statements they made. There were a number of loose and inaccurate statements, for example 'infected needles', or 'from mother to baby'. Some candidates tried to score three marks by describing the same route of transmission in three different scenarios.
- (c) This question discriminated well. Many students knew that antibiotics cannot be used to treat viral infections, but a number also thought erroneously that the constantly mutating protein coat of HIV, or the weakened immune system were the reason for antibiotics proving unsuccessful. There was some confusion between the terms 'antibiotic' and 'antibody'.



- (d) Candidates tended to muddle up ethical and practical reasons in their answers to this question. Most knew that the delay in the appearance of symptoms made accurate calculations of HIV infection rates difficult, but failed to think of a second valid reason. Answers such as 'invasion of privacy' were not credited here.

In the second part of the question, candidates again rarely mentioned two separate ethical issues and often incorrectly referred to practical issues such as the cost of the screening. References to confidentiality were not credited unless correctly qualified. Ethical problems most commonly mentioned were loss of freedom of choice with relatively few references to prejudice from insurance companies, potential employers etc.

#### **Teaching tip**

It is a matter of some concern that candidates are unfamiliar with the basic principles involved in the transmission of HIV/AIDS. Homework time could be allocated to research the topic from the wealth of information on the internet. This could be followed by a class discussion on the biological and ethical implications of the present situation.

## 2858 / 01 Case Studies

### General Comments

The Case Studies component is intended to be taken once components 2856 and 2857 have been completed and hence it was not surprising that a low number of candidates had been entered for the examination in January. Some excellent responses were seen and there was clear evidence that candidates had been encouraged to research around the two case studies. However, the high proportion of candidates scoring at grade E and below would seem to indicate that many were not as fully prepared as they might have been. Candidates need both a thorough grounding in the content of 2856 and 2857 and the time to analyse the Case Studies in the light of this content. **Therefore, entries can only be made in the January session for candidates carrying a coursework mark forward (i.e. resits).**

#### Teaching tip

Use the Case Study as part of your revision programme. Assist the candidates in looking for the links between the material in the Case Study and the learning outcomes in the specification.

### Comments on Individual Questions

#### THE GASEOUS EXCHANGE SYSTEM AND INFLUENZA

- Q.1 The examiners were pleased with the overall performance on this question. Several candidates referred to named neuraminidase inhibitors. This was evidence of research and was credited by the examiners. The identification of the tissues in Fig 1.3 proved difficult for all candidates. Recognition and interpretation of photomicrographs is part of the specification and, while it is recognized that not all Centres have easy access to microscopes or a good slide collection, there are some excellent images available on the web.

#### Teaching tip

Click on Google and use the images section of the search options to find images of biological material. Alternatively many Histology textbooks (e.g. Freeman and Bracegirdle, An Atlas of Histology which is quite old but has excellent photomicrographs) and many standard A Level textbooks, some of which provide Art Notebooks or CD ROMs of images, are all excellent sources.

- (a) (i) Most candidates scored well on this question with responses that referred to a 'group of cells' although ideas about specialisation were often vaguely described. Very few candidates picked up on the presence of intracellular material in some tissues or that a tissue can have a variety of cell types as evidenced by the ciliated cells and the goblet cells present in ciliated epithelial tissue.
- (ii) Many candidates identified that tissue R was epithelial tissue and this did not gain credit unless reference to ciliated epithelium was made. No candidate successfully identified S as cartilage which perhaps indicates a lack of 'microscope' work within Centres and is commented on above.

- (iii) This was well answered by all but the weakest candidates and, although it was not required, many candidates identified the goblet cells and their role in the secretion of mucus as part of their explanation.
- (b) This question was answered well although there was evidence that some weaker candidates could not distinguish between the blood group and their respective antigens and antibodies. It was not uncommon to see A, B and AB or “antigens A B and O” given as antigens present in blood group AB.
- (c) It was surprising that, having identified diffusion and osmosis as two means of entry into cells, many candidates seemed stuck for a third example. Some high scoring candidates successfully identified both a mechanism and an example such as “active transport for the uptake of ions”. There was some evidence that not all candidates appreciated that phagocytosis and pinocytosis were both forms of endocytosis and were possibly unfamiliar with this term.
- (d)(i) Only high scoring candidates spotted the role of the nuclear pore in allowing the viral RNA into the nucleus. This is arrowed in the diagram provided in the Case Study and the response to this question and to part (f) suggests that candidates did not study the diagram as closely as the text.
- (ii) While the examiners were happy to accept a correct response given in one column – for example, “RNA has ribose and DNA doesn’t” – most candidates contrasted the two molecules. Weaker candidates merely stated the “RNA is ribonucleic acid, DNA is deoxyribonucleic acid” and made no comment on any difference in STRUCTURE. The spelling of thymine and uracil was a little erratic but, as the Examiners were happy to accept T or U, this was not penalised.
- (e) This question was poorly answered by all but the most able candidates. Most candidates merely restated that the structure of the haemagglutinin would be changed so it would no longer “bind to its substrate” but the question required an explanation of how this change was brought about. The Examiners were looking for awareness that it was the presence of hydrogen ions that would bring about the change and that it was the tertiary structure and bonds between R groups which would be disrupted. An **explanation** of the role of pH in enzyme activity is a part of the specification (5.1.1.5b) and not just a description of the fact that some enzymes have a pH optimum.
- (f) This was done well by the majority of candidates but see the comment above for d (i)
- (g) This question proved to be a good discriminator, with weaker candidates failing to note the comment in the Case Study regarding the role of neuraminidase in the release of the virus particles rather than in the infective stage, although credit was given if candidates related the breakdown of mucus with facilitating the attachment of the virus to the target cell. Credit was given for references to the Case Study material and for evidence of further research. It is hoped that candidates will use the time available from the pre-release date to pursue the topic independently.

## PNEUMOCOCCAL INFECTION

**Q.2** There was no real evidence that candidates were pressed for time with many extended answers running onto the second page. On the whole, performance on the second question mirrored that of the first, although the presence of a 'biochemistry based' question possibly depressed the marks slightly. Some candidates appeared to carry over ideas from question one with incorrect references to viruses in both parts (a) and (g).

- (a) This was answered well by the majority of candidates although there was some evidence that candidates thought the virus of the first question was a 'prokaryotic cell' with answers referring to prokaryotes having 'no life outside the host cell'.

### Teaching tip

Ask the candidates to produce 'WANTED' posters with descriptions of prokaryotic cells. Use the main bacterial pathogens in the specification such as *Mycobacterium tuberculosis*. The 'REWARD' can reflect the incidence or the mortality rate from TB and its economic importance.

- (b) Again, this question was answered well with many candidates referring to the breakdown of the immune system in the elderly. The examiners were looking for a clear indication that this was what the candidate was describing rather than just a loose reference to 'age' affecting the immune system.
- (c) The examiners were pleasantly surprised at the performance on this question with most candidates getting the answer correct. Centres are to be congratulated on training their candidates to handle data confidently. It was clear that the information given in the case study had been studied carefully by candidates.
- (d) The responses to this question were disappointing. Candidates often find biochemistry difficult but candidates who scored well on this question were not necessarily the highest scoring candidates overall. Again this possibly indicates either a lack of time to review the biochemistry thoroughly or a general unfamiliarity with terms such as polysaccharide – although this is highlighted in the specification (learning outcome 5.1.1.2I). Candidates are expected to be familiar with terms such as "condensation reaction" and "glycosidic bond". The use of fully labelled diagrams when questions ask for a "description" is a good examination technique which was adopted by several candidates who scored well on this question.
- (e) Candidates find it difficult to structure logical answers under the pressure of an examination and this question was targeted at the most able candidates. The Examiners were looking for an understanding of the nature of specificity in antibodies and credit was given for references to the variable region and complementary relationship between the variable region and the binding site on the antigen. Candidates then had to extend this idea to address the question and this was where many failed to score.

### Teaching tip

When revising, encourage the candidates to review ideas on the tertiary structure of proteins in the context of enzymes, antibodies and haemoglobin. Quaternary structure can also be reviewed in the context of antibodies and haemoglobin. Specificity and the link between structure and properties are then applied by candidates in context. This is the ethos behind this specification. (see (f) also)

- (f) The most able candidates recognised that antibodies **are** plasma proteins. Again, the advantage of learning 'difficult' biochemistry in the context of the specification would have made ideas such as those tested in this question more accessible to candidates.
- (g) Although all candidates scored some marks on this question it was noticeable that even high scoring candidates failed to achieve the maximum marks. Yet it was clear that most candidates were familiar with the principles of control of airborne infections. Careless descriptions of the cycle of infection cost many candidates marks. For example, coughing and sneezing were identified as spreading the bacteria without reference to droplets of mucus or that it was an **infected** person who was coughing and few candidates mentioned the fact that the droplets would have to be inhaled by a susceptible person. Many candidates went on to discuss the problems of limiting transmission in a care home without necessarily indicating exactly what could be done by way of precautions. Credit was given for reference to the use of a vaccination programme.

## 2866 Energy, Control and Reproduction

### General Comments

This paper is an A2 paper that requires the depth of knowledge and understanding acquired from a detailed study of the specification. One third of the marks cover synoptic material by testing the learning outcomes and skills in the AS papers, in the context of this module. It was clear that many candidates were finding it difficult to translate the approach used for the AS papers into a more detailed understanding for this more demanding paper. Answers were largely superficial and few candidates in this small entry accessed the synoptic marks efficiently. Human Biology is a subject in which the synoptic links between modules are clear.

There was considerable inconsistency in the performance on different questions. A number of candidates produced excellent answers for some questions but left others blank, indicating that their knowledge was patchy. In a few cases doubt was raised as to whether the candidate had studied the topic at all. For many candidates, entering for this paper will be a useful exercise in preparation for the summer examination although the Examiners were pleased to see some good scripts.

### Comments on Individual Questions

- Q.1            The first question was intended to be a gentle start to the paper and many candidates managed to score over half marks for the question. Others however, could not cope with the straightforward recall.
- (a)            Most candidates correctly stated that the autonomic nervous system could be divided into the sympathetic and parasympathetic systems.
  - (b)(i)        There was a clear distinction between those candidates who could recall the names of these structures and those who were guessing.
  - (ii)           Many candidates could not distinguish between general descriptive points and the features unique to a motor neurone, i.e. the cell body being located at the end of the neurone.
  - (ii)           Many candidates found this difficult and could not describe processes such as the behaviour of the vesicles in the synaptic knob, and the position of the receptors accurately. It was pleasing to see from some candidates a description of the importance of the refractory period in determining the direction of the nerve impulse. Candidates with a sound knowledge of this topic easily scored 3 marks.
  - (c)(i)        Marks were given in this question for the effect on the nervous control of the heart and the effect on the function of a lack of stimulation on the heart muscle. Additional marks could have been gained for references to the coronary arteries and the term myocardial infarction as well as the death of the heart muscle.
  - (ii)           Marks for this question were disappointing. The examiners had expected a description of the technique with references to the positioning of the leads to produce twelve different traces, which have to be compared. Most candidates identified the ECG as the technique and could note that electrodes were attached to the chest.

- Q.2 It was clear that many candidates were not happy with this topic although some scored well. The question was targeted mainly at the upper end of the ability range.
- (a)(i) There were some pleasing definitions of deflected succession, including the terms climax and plagioclimax. Deflected succession is a term in bold in the specification and it is therefore expected that candidates will be able to quote the definition. The examiners were prepared to accept a description to illustrate the definition but would not award a mark for the same example in (ii).
- (ii) Most candidates had little difficulty in producing two examples, but a few did not read the question and produced examples that were nothing to do with agriculture.
- (b) Many candidates found these data very difficult to interpret including correctly reading the scale. A common misunderstanding was the assumption that if the food production per head is above the total food production there is not enough food to go round and vice versa. Marks are always awarded for figures correctly quoted with units. Those candidates who produced these maximised their mark. Very few candidates identified the size of the population as a significant factor in producing these data.

**Teaching tip**

Candidates could use past papers, e.g. from 2805/3 Environmental Biology and 2805/5 Mammalian Physiology and Behaviour, to collect examples of data that may be analysed as a class exercise or individually as homework.

- (c) Most of the answers to this question covered ethical implications fully but paid little attention to the biological implications. It appeared that many candidates could not make the distinction and whilst the mark scheme allowed for this, a maximum mark was only possible if both aspects were covered in the answer. The examiners were hoping to see the question answered using relevant statements and were reluctant to accept ethical answers in the form of questions (e.g. is it right to interfere with nature?) unless they were very fully argued. This skill needs to be practised as class discussions and published material may produce a question approach. The Examiners were pleased to see that virtually all candidates scored the QWC mark for legible text and accurate spelling, punctuation and grammar.
- Q.3 This question needed to be read carefully to avoid repetition of answers for each sub-section. The question was divided up in this way to help candidates sequence their knowledge logically but it was clear that the tendency to 'write all you know about' operated in many cases.
- (a)(i) Many candidates understood fully the behaviour of the haemoglobin molecule as it binds with oxygen but not all candidates were able to translate this into an explanation of the shape of the curve.

- (ii) The majority of candidates correctly identified the effect of CO<sub>2</sub> on the saturation of haemoglobin but fewer used the graph by quoting figures or naming the Bohr effect as the curve is pushed to the right.
  - (iii) This question was aimed at the higher end of the ability range but few candidates were able to describe the buffering effect of haemoglobin, the formation of haemoglobinic acid or the consequent effect on the affinity of haemoglobin for oxygen.
  - (iv) It was hoped that candidates would be able to explain the importance of this effect during exercise in answering the demand for oxygen but the majority repeated information already given in previous answers. A significant number of candidates thought that releasing the oxygen from haemoglobin reduced its availability to the muscles for respiration, whilst taking oxygen up increased it.
- (b) The answers to this question were pleasing. Most candidates could identify the pigment as myoglobin in slow twitch fibres and went on to discuss its increased affinity for oxygen in comparison with haemoglobin and its consequent advantage as a backup supply. Many also stated that these fibres had more mitochondria and therefore supplied ATP over a longer period.

**Q.4** Many candidates scored well on the first part of this question, but the later parts were synoptic and scored poorly.

- (a) The interpretation of these data provided a mark yielding extended answer. The majority of candidates successfully described and explained the results of the experiment. Many candidates correctly stated that a high carbohydrate diet led to an increase in glycogen stores and allowed the students to cycle for longer. Some linked this to the hydrolysis of glycogen and its use in respiration to generate ATP. The involvement of ATP in muscle was rarely seen, and a common misconception was that glucose is essential for aerobic respiration. The QWC mark in this question was for quality of use and organisation of scientific terms, and this was rarely awarded as few candidates used any specialist terms when answering this question. For example, the mark could have been gained by referring to the hydrolysis of glycogen to yield glucose, and the oxidation of the glucose in aerobic respiration. Some candidates mentioned a phase in the respiratory pathway and a few candidates referred to the importance of ATP in muscle contraction and the ATPase in the myosin head.
- (b)(i) This question was poorly answered, with few candidates understanding that glucose would dissolve in the water in the gut, lowering water potential and drawing water from the surrounding tissues. Many candidates thought that the glucose would absorb the water in the gut, preventing it from entering the bloodstream, leading to dehydration.
- (ii) This question was answered well, with many correctly identifying the use of an isotonic drink to avoid dehydration.
- (c) This section was generally answered well with many candidates listing long term effects such as hypertension, increased risk of heart disease and obesity. Being overweight was not credited as the Examiners were looking for 'obesity'.



- Q.5** Many candidates found this question very testing, and there was obvious confusion on the sequence and mechanism of the pregnancy test.
- (a) Few candidates gained full marks for this question. Examiners were looking for a reference to increasing folic acid uptake or to checking that immunity to Rubella was present before becoming pregnant. Many of the candidates' answers were too vague to gain credit, referring to the need for a balanced diet or relating to tests done after pregnancy is confirmed.
- (b)(i) There was a great deal of confusion on the sequence and mechanism of the pregnancy test, with many candidates knowing that the antibodies would combine with HCG in the urine sample, but little else. The examiners were hoping to see the idea of this complex being carried to a line of immobilised antibodies where they would bind to form a coloured line, indicating pregnancy. Very few candidates stated that a second line would appear to indicate that the test was working, or explained how this line was formed.

**Teaching tip**

Help the candidates to produce an annotated drawing of a pregnancy test or flow chart listing the sequence of events involved.

- (ii) Very few candidates got the idea that all the antibodies were the same, and that they were specific for the HCG antigen.
- (iii) This section was generally answered well with many candidates stating that the corpus luteum secretes progesterone to maintain the endometrium although a few candidates clearly had no idea.
- (c)(i) Candidates found it difficult to distinguish between the roles of prolactin during pregnancy and following the birth of a baby. Examiners were looking for references to prolactin stimulating the growth of breasts and glandular tissue to prepare for milk production, or the idea that prolactin is inhibited by the presence of oestrogen or progesterone.
- (ii) Many candidates understood that prolactin controlled milk production, but some stated that it caused the release of milk from the breast, which gained no credit. A few stated that prolactin production was increased by suckling, or by the lowering of oestrogen or progesterone levels.

**Q.6** This was generally well answered though some candidates had difficulty expressing their ideas in (d).

- (a)(i) Most candidates got this question correct.
- (ii) Although candidates knew that light splits rhodopsin into retinal and opsin, few could give any further detail about the process.
- (iii) Candidates found this section difficult, and often missed it out. Some correctly identified the need for respiration for ATP production, but few could say what the ATP might be used for within the rod cells. A common misconception was to say that ATP was needed to split rhodopsin.
- (b) Although many candidates scored well on this section, a few lost marks for failing to make direct comparisons between features.

**Teaching tip**

The table in the mark scheme is a useful teaching tool to show how to make comparative statements. Usually only one mark is given for the two comparative features.

- (c) Many candidates correctly identified the role of bipolar neurones in forming two synapses linking rod or cone cells to the ganglion cells.
- (d) Candidates had difficulty expressing their ideas on paper in this section. Most candidates correctly stated that several rods were linked to each bipolar cell, but most did not follow this through to see that less neurotransmitter was required to fire the rod cell or that one photon of light would be enough to produce a response.

**Advanced Subsidiary GCE Human Biology 3886**

**Advanced Level GCE Human Biology 7886**

**January 2005 Assessment Session**

**Unit Threshold Marks**

Unit		Maximum Mark	a	b	c	d	e	u	Total Number of Candidates
<b>2856</b>	Raw	60	47	41	35	29	23	0	808
	UMS	90	72	63	54	45	36	0	
<b>2857</b>	Raw	60	46	40	34	29	24	0	207
	UMS	90	72	63	54	45	36	0	
<b>2858/01</b>	Raw	45	36	32	27	23	18	0	36
	UMS	60	48	42	36	30	24	0	
<b>2858/02</b>	Raw	60	not available in the January session					0	n/a
	UMS	60						0	
<b>2866</b>	Raw	90	68	59	51	43	35	0	232
	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

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>	0.0	0.0	11.1	44.4	77.8	100.0	9
<b>2866</b>	5.4	16.7	32.4	49.1	73.9	100.0	232







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