

Human Biology

Advanced GCE

Unit **F225**: Genetics, Control and Ageing

Mark Scheme for January 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.









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Abbreviations, annotations and conventions used in the detailed Mark Scheme.

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not	answers which are not worthy of credit
reject	answers which are not worthy of credit
ignore	statements which are irrelevant
allow	answers that can be accepted
()	words which are not essential to gain credit
—	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Annotations: the following annotations are available on SCORIS.

Annotation	Meaning
	correct response
	incorrect response
	benefit of the doubt
	benefit of the doubt not given
	error carried forward
	information omitted
	ignore
	reject

Highlighting is also available to highlight any particular points on the script.

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text:

Question	Answer	Mark	Guidance
	<p>(iii) <i>autosomal</i> not a sex chromosome ;</p> <p>AND ANY TWO FROM <i>linkage</i> loci F and G close together (on chromosome) ;</p> <p>less chance of a , cross over event / chiasma formation, between them ;</p> <p>(so more likely to be) inherited together ;</p>	3	<p>CREDIT reference to chromosome 9 being an autosome</p> <p>ACCEPT reference to genes or to genes for ABO and nail patella syndrome.</p> <p>CREDIT reverse argument - both exchanged together during cross over event</p>

Question		Answer	Marks	Guidance
	(c)	(messenger / m) RNA ; another transcription factor ; protein / polypeptide ;	2	ACCEPT RNA unqualified DO NOT CREDIT rRNA or tRNA
	(d)	<i>Symptoms</i> (leads to) reduced field of vision / tunnel vision ; idea of misty vision ; 'halos' around objects ; red / bloodshot eyes ; <i>2max</i> <i>changes in the eye</i> (tests detect) increased pressure inside eye ; (gradual) damage to optic nerve ; ref to closed / open angle ; <i>2max</i>	3	MARK UP TO TWO SYMPTOMS MARK UP TO TWO CHANGES CREDIT description of changes in eye which reduce drainage of fluid

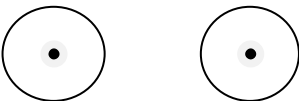
Question		Answer	Mark	Guidance
	(e)	<p>idea that basement membrane no longer acts as molecular filter ;</p> <p>idea of substances entering, bowman's capsule / filtrate ;</p> <p>(protein) not reabsorbed ;</p> <p>erythrocytes / red blood cells , present in urine ;</p> <p>protein present in urine ;</p>	3	<p>Can be awarded if candidate refers to reduced efficiency of filtration.</p> <p>CREDIT idea that 'cut off' size is no longer 70 000 Daltons / large molecules / proteins leave blood</p> <p>DO NOT CREDIT 'glucose' as this normally appears in the filtrate</p> <p>DO NOT CREDIT protein if given as part of a list with glucose but penalise once only.</p> <p>eg 'Glucose, protein and red blood cells will be present in urine' would score 1 mark.</p>
Total			19	

Question		Answer	Marks	Guidance
2	(a)	<p><i>mechanism</i></p> <p>M1 (regulated by) negative feedback ; M2 <u>stimulus</u> is rise in blood glucose / ORA ;</p> <p>M3 (rise or fall) detected by (cells in) Islets of Langerhans ; M4 (rise in blood glucose) β / beta , cells release insulin ; M5 insulin stimulates increased uptake of glucose by , liver / muscle , cells ; M6 (insulin stimulates) increased respiration of glucose ; M7 (insulin stimulates) conversion of glucose to glycogen / glycogenesis ; M8 (fall in blood glucose) α / alpha , cells release glucagon ; M9 glucagon stimulates , glycogenolysis / breakdown of glycogen to glucose ; M10 (glucagon stimulates) gluconeogenesis / described ; M11 (glucagon stimulates) increased respiration of fats / less respiration of glucose ;</p> <p><i>reasons</i></p> <p>R1 idea that glucose has an osmotic effect ; R2 water drawn out of cells (by osmosis) ; R3 (water loss) leads to , cellular damage / described ; R4 idea that high glucose results in increase in blood, volume / pressure (leading to heart attacks) ; R5 blood glucose is respiratory substrate ;</p>	9max	<p>CREDIT fall in blood glucose is <u>stimulus</u> for glucagon release.</p> <p>M6 ACCEPT glucose respired instead of fats</p> <p>CREDIT conversion of , amino acids / AW , to glucose</p> <p>R1 CREDIT for correct reference to high and low water potential R3 ACCEPT any named example of damage due to high blood glucose eg neuropathy / retina damage</p> <p>R7 ACCEPT ref to low blood glucose leading to dizziness</p>

Question			Answer	Marks	Guidance
			R6 necessary for neurones / AW ; R7 ref to (diabetic) coma ;		Look for a general comment on the use of glucose in respiration in cells for R5
			QWC ;	1	Award QWC if answer has been awarded at least 3 M marks plus R1 and R5 .

Question		Answer	Marks	Guidance
	(b) (i)	BMI < 20 / BMI > 40 ; all data, on / close to, the line ;	2	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT 'confidence limits very, small, narrow'
	(ii)	confidence limit increases / AW ; <i>idea that</i> this data is , generated by the model / not real, actual data / extrapolated ; <i>idea that</i> there is no guarantee that , conditions / factors , affecting this will occur as expected ;	2	ACCEPT idea that zone gets wider CREDIT idea that data is more of an estimate IGNORE ref to 'predictions' as this is given on the graph CREDIT idea that eg lifestyle could change in the future
	(iii)	<i>from Table 2.1</i> (large) increase risk of diabetes (over time) in groups where BMI is greater ; data quote in support ; <i>from fig. 2.1</i> percentage of people in higher (risk) BMI categories increases (over time) ; data quote in support ;	3	must be a comparative statement – two BMI ranges and two risk values from Table 2.1 ACCEPT responses which use BMI 30 – 40 as high(er) risk category must be a comparative statement (30 – 40 BMI range) and two years from Fig. 2.1 OR calculated difference

Question		Answer	Mark	Guidance
	(iv)	BMI ranges overlap / AW ; BMI ranges are different on the graph and in the table ; BMI ranges vary in size (on the graph / Table 2.1) ;	2	LOOK FOR an example from Table 2.1 or Fig 2.1 eg '23 is in 2 categories' (Table), / '30 is in two categories' (graph)
(c)	(i)	<i>GL of basmati rice</i> 22 ; <i>mass of digestible carbohydrate</i> 32 ;	2	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks DO NOT CREDIT if answer is not given as a whole number (as data in table is also given as whole numbers). Penalise once only.
	(ii)	low GI foods contain , undigested carbohydrate / AW ; undigested material / AW , acts as dietary fibre ; fibre / AW , increases , bulk of stools / AW ; fibre / AW , decreases time spent in, (large) intestine / colon ;	2	IGNORE reverse argument 'not a lot of digestible carbohydrate' eg named undigested carbohydrate such as cellulose
			Total 23	

Question		Answer	Marks	Guidance
3	(a)	<p>iris ; vitreous humour ; macula / fovea / yellow spot ; cone ;</p> <p>autonomic / peripheral ; sympathetic ; parasympathetic ;</p> <p>reflex ;</p>	8	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT phonetic spelling</p> <p>IGNORE 'arc'</p>
	(b)	(i)		
		<p>(dim light) idea that pupil partially dilated so some constriction will be seen OR to standardise the test each time ;</p> <p>(several times) for a <u>reliable</u> result OR one response could be atypical ;</p>	2	<p>Look for the idea of 'so it is dilated to start with'</p> <p>ACCEPT idea that light within the room could also affect the pupil size</p> <p>DO NOT CREDIT 'reliable' if part of a list with 'accurate' or 'precise' or 'valid'</p>
		(ii)		
			1	<p>Look for both pupils same size and smaller than on Fig. 3.1(a) IGNORE position of pupils within the circle</p>

Question		Answer	Marks	Guidance
	(c)	<p>choroid / underlying layer , supplies , oxygen / glucose , to retina / rod cells / cone cells ;</p> <p>retinal cells / AW , cannot , respire / produce ATP ;</p> <p><i>idea that</i> retinal cells / AW , cannot act as receptor ;</p> <p>AVP ;</p>	2	Look for idea that an action potential is not being triggered by the light
	(d)	<p>blink reflex / AW ;</p> <p>AVP ;</p>	1	<p>CREDIT a description of the blink reflex</p> <p>eg 'hello, can you hear me?'</p> <p>ACCEPT 'MRI (scan) as these can be used to assess 'locked in syndrome'</p> <p>IGNORE ref to knee jerk response as this is not normally used to assess consciousness</p>
Total			14	

Question		Answer	Marks	Guidance
4	(a)	<p>1 arterial blood removed / AW ; 2 description ;</p> <p>3 A keeps <u>blood</u> , moving / pressurised ;</p> <p>4 B adds (named) anticoagulant ; 5 (anticoagulant) prevents clotting (in machine) ;</p> <p>6 C idea of tubes of , dialysis membrane / partially permeable membrane ; 7 tubes / AW , surrounded by dialysis fluid ;</p> <p>8 <i>idea that</i> composition of dialysis fluid has correct levels of , glucose / ions / urea ;</p> <p>9 <i>idea that</i> urea / ions , <u>diffuse</u> , from blood to (dialysis) fluid / AW ;</p> <p>10 detail of fluid flow (in dialyser);</p> <p>11 D is air trap / air detector / bubble detector ; 12 prevents , embolisms / air bubbles in blood vessels ;</p> <p>13 blood returned into a vein ;</p> <p>14 reference to time taken ; 15 reference to frequency ;</p> <p>QWC ;</p>	9	<p>CREDIT annotations on diagram</p> <p>2 eg taken from , a shunt / fistula DO NOT CREDIT 'stent'</p> <p>3 CREDIT 'A pumps <u>blood</u>'</p> <p>4 DO NOT CREDIT ref to sodium citrate 5 DO NOT CREDIT 'agglutination'</p> <p>6 ACCEPT visking tubing</p> <p>7 ACCEPT idea that C contains dialysis fluid</p> <p>9 CREDIT idea that <u>diffusion</u> occurs so blood equilibrates levels of ions etc</p> <p>10 eg blood and fluid flow in opposite directions / countercurrent</p> <p>14 eg 3–4 hours (daily) or 6–10 hours (nocturnal) 15 eg 3–4 times per week</p>
			1	<p>Award QWC mark if answer has been awarded for any two marks from mps 3, 4, 6, 11</p>

Question		Answer	Marks	Guidance
	(b)	(calcium) phosphate / minerals , build up/ AW, (in wall of) <u>artery</u> ; loss of elasticity ; (blood vessel) does not , expand / AW , during (ventricular) systole ;	2	IGNORE ref to blood vessels (as given in question) DO NOT CREDIT if vein included ACCEPT 'hardening of arteries' / <u>arteriosclerosis</u>
	(c)	removes calcium ions ; acts as an anticoagulant / prevents blood clotting ; calcium ions are co-factor for blood clotting ; (removing calcium) prevent calcium ions combining with phosphate ; acts as a buffer ; reason for change in pH ;	2	
		Total	14	

Question		Answer	Marks	Guidance																													
5	(a)	<p>hearing normal at low(er) frequencies for both ears ;</p> <p>hearing in left ear better than right ear at , lowest frequency / 250 Hz, up to 500 Hz ;</p> <p>in both ears, hearing loss greater at higher frequencies ;</p> <p>loss in left ear greater than right ear, from 500 to 3600 Hz;</p> <p>severe hearing loss in both ears at highest frequency / 6000 - 8000 Hz ;</p> <p>data quote in support of description ;</p>	4	<p>CREDIT 'pitch' instead of 'frequency' in all mark points</p> <p>ACCEPT idea the idea of 'middle of the <i>frequency range</i>'</p> <p>data quote must contain reference to both frequency and level and must include units</p> <table border="1"> <thead> <tr> <th rowspan="2">frequency (Hertz /Hz)</th> <th colspan="2">level (decibels / dB)</th> </tr> <tr> <th>left ear</th> <th>right ear</th> </tr> </thead> <tbody> <tr> <td>250</td> <td>15</td> <td>20</td> </tr> <tr> <td>500</td> <td>20</td> <td>20</td> </tr> <tr> <td>1000</td> <td>25</td> <td>20</td> </tr> <tr> <td>2000</td> <td>40</td> <td>35</td> </tr> <tr> <td>3000</td> <td>50</td> <td>40</td> </tr> <tr> <td>4000</td> <td>65</td> <td>70</td> </tr> <tr> <td>6000</td> <td>80</td> <td>80</td> </tr> <tr> <td>8000</td> <td>80</td> <td>80</td> </tr> </tbody> </table>	frequency (Hertz /Hz)	level (decibels / dB)		left ear	right ear	250	15	20	500	20	20	1000	25	20	2000	40	35	3000	50	40	4000	65	70	6000	80	80	8000	80	80
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	(b)	<p><i>idea that:</i></p> <p>may misunderstand what is said ;</p> <p>may feel , frustrated / angry/ embarrassed / depressed / AW ;</p> <p>may be, isolated ;</p> <p>may avoid social gatherings / less sociable ;</p> <p>may speak loudly (and not realise) ;</p> <p>AVP ; ;</p>	2	<p>Mark the first two answers.</p> <p>any two of experience problems with eg telephone conversations doctors' surgeries / shops crossing the road communicating with young people</p>																													

Question		Answer	Marks	Guidance
	(c)	<p><i>location</i> myelin sheath / Schwann cell(s) ;</p> <p><i>confirmation - max 2</i> MRI scan ; CT scan / CAT scan ;</p> <p>correct detail of technique given ;</p>	3	<p>eg use of magnetic field in MRI or X-Rays in CT DO NOT CREDIT inappropriate methods eg PET scan but allow ecf if correct details of the technique are given.</p>
		Total	9	

Question		Answer	Marks	Guidance
6	(a)	released from pre-synaptic, membrane / neurone / bulb ; move / diffuse, across synaptic cleft ; binds to, post synaptic membrane , receptors ; triggers action potential in post-synaptic neurone / AW ;	3	
	(b)	(i) it , has similar shape to endorphin / has complementary shape to the receptors ;	1	DO NOT CREDIT has the 'same shape'
		(ii) (drug) induces , false /AW, feeling of well being / AW ; <i>idea that users form habit of using, heroin / diamorphine to feel good ;</i>	2	Look for idea that feeling induced is an escape from reality LOOK FOR idea that users believe eg they must or need to take heroin regularly / that it is only way to be happy IGNORE references to 'tolerance' 'withdrawal', etc as these are linked to physiological dependency
	(c)	(i) <i>type of protein</i> enzyme / globular (protein) ; <i>substance X</i> carbon dioxide / CO ₂ ;	2	
		(ii) Parkinson's (disease) ; Plus up to two marks for any two of the following tremors stiffness slow / difficult, movements loss of balance uncoordinated movements AVP ; ;	1 2	CREDIT correct symptoms associated with Parkinson's even if disease has not been correctly identified.

Question		Answer	Marks	Guidance
	(d) (i)	(because code is a) <u>triplet</u> (genetic) code ; 3 bases / nucleotides, code for each amino acid ; correct ref to (role of) tRNA and anticodons ;	2	CREDIT in context of DNA or RNA (codons)
	(ii)	idea that gene will contain , introns / non-coding regions ; idea that only exons contribute to length of polypeptide ; idea that polypeptide is made as a longer pre-cursor ; AVP ;	2	eg ref to stop triplets ref to gene control regions
		Total	15	

Question		Answer	Marks	Guidance
7	(a)	<p><i>idea that</i> counsellor explains the risk of having another child with the same disease ;</p> <p>discusses possible options (eg IVF) ;</p> <p>AVP ;</p>	2	<p>ACCEPT idea that family tree or pedigree will be discussed.</p> <p>IGNORE 'to discuss possible, cures/ treatment' as this is given in the question</p> <p>eg to provide emotional support</p>
	(b)	<p>tissue / MHC alleles / , compatibility ;</p> <p>plus any one from idea that HLA antigens controlled by (MHC) alleles ; OR tissue must be a close match ;</p> <p>sex of baby ; explanation ;</p>	2	<p>IGNORE ref to testing for genetic disease(s) (as stated in question) ACCEPT compatible blood group, haplotype</p> <p>CREDIT to prevent rejection</p> <p>ACCEPT a response which implies it is possible to choose the sex of the baby in some circumstances</p> <p>IGNORE references to sex linkage</p>
	(c)	<p>use of , somatic cell nuclear transfer / SCNT / AW , to produce embryo</p> <p>OR patient's own, (embryonic) stem cells / nucleus (used) ;</p> <p>to grow into replacement tissues / organs to be used in treatment / AW ;</p>	2	<p>CREDIT named tissues eg blood</p>
Total			6	

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