GCE

Human Biology

Advanced GCE

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

Mark Scheme for January 2011

Question			Expected Answers	Mark	Additional Guidance
1	**(a)**		lack of glucose **;** lack of oxygen **;** (leading to) no / reduced, <u>aerobic</u> respiration **;** no / reduced ATP for, named process **;**	**2 max**	**ACCEPT** idea that brain / cells / tissues need oxygen or glucose eg no ATP for active transport
	(b)	**(i)**	13 <u>%</u> **; ;**	**2**	Correct answer = 2 marks, even if no working shown Award 1 mark if % is omitted Award 1 mark if 9% is given (correct method but incorrect blood pressure reading)
		(ii)	(high blood pressure) damages, lining / endothelium / tunica intima (of artery) **;** lipids / cholesterol / fats, build up <u>in the (artery) wall</u> **;** (due to) action of, macrophages / foam cells **;** (forming) atheroma / (atheromatous) plaque **;** (formation of) thrombus / clot **;** lumen narrows / description (so blood flow reduced) **;**	**4 max**	**IGNORE** epithelium **IGNORE** 'coronary' artery as question refers to organs such as the brain **CREDIT** correct reference to atherosclerosis **DO NOT CREDIT** narrowing of artery

Question			Expected Answers	Mark	Additional Guidance
	(c)		(the 20% risk group)		no mark for choosing the group if incorrect group chosen, max 1 both marks to be awarded for reasons
			(because) could previously have had, some damage / mini strokes / symptomless strokes **;**		looking for the idea that there is some damage but not a full stroke
			in, parts of the brain affecting memory / cerebral cortex / cerebrum **;**		
			(because) they had a high FSRF score **;**		
			(due to) high blood pressure / diabetes / (old) age / being female **;**		eg (due to side effects of) drugs used to treat, high blood pressure / diabetes / CHD / AW
			AVP **;**	**2 max**	

Question		Expected Answers	Mark	Additional Guidance
(d)		remind of , family / friends / familiar places / objects, by photos / visits ;		idea of remembering people or places or objects they are close to or know well
		show pictures from, newspapers / magazines / TV images / AW ;		idea of remembering famous people such as the Queen or Prime Minister or events such as the Olympics
		(play) memory games / brain trainer ;		**CREDIT** a description such as Kim's game eg removing an object and asking them to remember
		display a calendar ;		idea of remembering date / day
		use adhesive notes / AW ;		idea of labels or reminders around the house
		cognitive / speech / rehabilitation / other named, therapy ;		eg music therapy, art therapy
		idea of regular practice / repeating exercises ;	**4 max**	
(e)		subject given, named / described substance ;		eg positron emitting substance / gamma ray emitting substance / 2-deoxyglucose / FDG / radioactive glucose **ACCEPT** phonetic spelling
		(subject) placed in scanner and asked to remember a *specified* object ;		idea of being memory tested during the scan
		(2 deoxyglucose) taken up by, respiring cells ;		**ACCEPT** metabolically active cells or tissues or areas of brain
		(glucose) breaks down to emit, positrons / gamma rays ;		
		more metabolically active cells, accumulate more FDG / give off more emissions ;		**ACCEPT** idea of more gamma rays given off
		scanner detects emissions from different parts of the brain ;	**4 max**	**ACCEPT** idea that an image of brain is produced / more active areas / tissues show up more brightly

Question			Expected Answers	Mark	Additional Guidance
(f)	**(i)**		A ; C ; C ;	**3**	**CREDIT** max 1 if the same letter is given for marking points 2 and 3 as this is 'error carried forward' This shows that candidates recognise that these two functions are controlled by the same area of the brain.
(f)	**(ii)**		formation of (neurofibrillary) tangles **and** plaques ; (tangles) within neurones ; (due to) accumulation of tau protein ; (plaques) deposits, between / around, neurones ; (formed from) abnormal / excess of, beta amyloid protein ; abnormal (cerebral) cortex / described ; (idea) less neurotransmitter secreted (from cells in regions with plaques and tangles) ;	**3 max**	**ACCEPT** idea that there is a build up
			Total	**24**	

Question			Expected Answer	Mark	Additional Guidance
2	**(a)**				Treat references to peri-menopause and menopause as changes *during* menopause
			changes during **D1** irregular periods **;** **D2** hot flushes **;** **D3** fatigue **;** **D4** mood changes / irritability / anxiety **;** **D5** sleep disturbance **;** **D6** memory loss **;** **D7** loss of libido / AW **;**		
			changes after **A1** ovulation stops **;** **A2** menstruation / AW, stops **;** **A3** reproductive organs become smaller **;**		**ACCEPT** a specific example or description eg fallopian tubes become narrower
			A4 vaginal, dryness / irritation of outer reproductive structures **;** **A5** vaginal discharge **;**		**ACCEPT** irritation of labia
			A6 calcium loss from bone / reduction in bone mass **;** **A7** (leading to) osteoporosis / description of osteoporosis **;** **A8** increase in % body fat **;** **A9** increase in blood cholesterol **;**		
			hormonal changes **H1** lower concentrations of , oestrogen **and** progesterone **;** **H2** higher concentrations of FSH **;**	**9 max**	**DO NOT CREDIT** unless both hormones are given and the idea that concentrations are lower
			QWC **;**	**1**	Look for at least one **D**, one **A** and one **H** mark

Question			Expected Answer	Mark	Additional Guidance
(b)	**(i)**		(results from) randomised / blind / double blind / other named type of, trial ; (idea of) large sample involved / many trials carried out ; (showing) reduction in symptoms / effective ; no adverse side effects / safe ; does not contain, banned / illegal substances ;	**3 max**	**CREDIT** prospective / intervention, studies / clinical idea of 'does it work' **ACCEPT** ref to cannabis / tissues from endangered animals **IGNORE** references to cost effectiveness as this question is not about prescribed drugs
	(ii)		phyto-oestrogens ; antioxidants ; isoflavones ; named herbal ingredient ;	**1 max**	**DO NOT CREDIT** oestrogen or progesterone or HRT **ACCEPT** phonetic spelling **ACCEPT** St John's wort, cannabis, THC, cannabinol,
(c)			increase in % survival at 1 year <u>and</u> 5 years ; increase in % survival at 5 years is less (than 1 year) ; data quote ;	**3**	**ACCEPT** reverse argument 'increase is greater at 1 year' must have two years **OR** imply a time period **AND** either two % quotes **OR** calculated difference

year(s)	% 1 year	% 5 year	% difference 75 - 91
71-75 (71)	46	23/24	
76-80	47	24	
81-85	53	28	
86-90	56	29/30	
91-95 (95)	58	29/30	12 (1 year) 6 (5 years)

6

Question			Expected Answer	Mark	Additional Guidance
(d)	(i)		higher % survival for breast cancer at 1 year **and** 5 years ; little difference between % survival at 1 year and 5 years for breast cancer ; data quote ;	3	**ACCEPT** reverse argument ' big drop in % survival between 1 year and 5 years for ovarian cancer' must have year **OR** imply a time period **AND** either two % quotes **OR** a calculated difference

years	breast cancer		ovarian cancer	
	% 1 year	% 5 year	% 1 year	% 5 year
71–(75)	82	52	46	23/24
76-80	85/86	59/60	47	24
81-85	87/88	62	53	28
86-90	88	67/68	56	29/30
(91)-95	90	70	58	29/30

Question			Expected Answer	Mark	Additional Guidance
(d)	(ii)		(idea) screening programme for breast cancer / no screening programme for ovarian cancer ; breast cancer symptoms are more easily recognised ; (idea) breast cancer has a higher profile ; breast cancer has known genetic links ;	2 max	**CREDIT** reverse argument 'ovarian cancer symptoms harder to spot' eg women less likely to be on the look-out for symptoms of ovarian cancer / that women are more aware of breast cancer / ovarian cancer does not have such a high profile idea that members of family will be tested if a sister / mother has breast cancer
	(iii)		chemotherapy / surgery / immunotherapy / radiotherapy ;	1	**DO NOT CREDIT** mastectomy **ALLOW** complementary therapy **ACCEPT** hysterectomy
			Total	23	

Question			Expected Answers	Mark	Additional Guidance
3	**(a)**		E / D ; B ; C ; J ; G ;	**5**	

Question			Expected Answers	Mark	Additional Guidance
(b)		1	water potential in blood plasma falls ;		
		2	(change in water) detected by osmoreceptors ;		
		3	(release of ADH) from neurosecretory cells ;		**ACCEPT** a description of nerve cells or neurones secreting ADH
		4	from (posterior) pituitary ;		
		5	(released into) blood / transported in blood ;		**CREDIT** released into or transported in plasma
		6	binds to (complementary) receptors, on cell surface membrane ;		
		7	(of) cells in wall of the <u>collecting duct</u> / AW ;		
		8	stimulates cyclic AMP ;		
		9	increases number of aquaporins in cell surface membrane ;		
		10	(as shown by) more fluorescence at surface membrane / AW ;		Look for the idea that the technique allows the aquaporins to be seen in the cell surface membrane if ADH is present
		11	(causes) cells to increase permeability to water ;		
		12	(more) water reabsorbed ;		**ACCEPT** description eg water leaves collecting duct
		13	(water moves) by osmosis ;		**ACCEPT** in any correct context
		14	into, capillaries / vasa recta / AW ;		**ACCEPT** absorbed into blood
		15	resulting in increase in water potential in blood ;	**8 max**	
			QWC ;	**1**	mp 10 must be linked to either mp 9, 11 or 12

Question			Expected Answer	Mark	Additional Guidance
(c)	(i)		water continues to be reabsorbed / too much water reabsorbed / water not excreted ;		
			no negative feedback / high water potential not detected ;		
			ADH continues to be released ;		idea that uptake of water does not 'switch off' ADH release
			no, increase in Na$^+$ uptake / no increase in Na$^+$ reabsorption / sodium ions still excreted ;		**DO NOT CREDIT** sodium / Na
			blood volume increases ;	2 max	**ACCEPT** idea that sodium ions diluted by excess water
	(ii)				**CREDIT** 1 mark if type of dependency or addiction is not specified
			can lead to physical dependency ; can lead to psychological dependency ;		
			interfere with / AW, synaptic transmission ; affects action of neurotransmitters in brain / described ;		**ACCEPT** idea of delusions or paranoia **IGNORE** 'modifies brain function' as this is given in the question
			Total	2 max 18	

Question			Expected Answer	Mark	Additional Guidance
4	**(a)**		lower case (h) = wild type / normal **and** same letter upper case (H) = Huntington's ;		**ACCEPT** any letter throughout **DO NOT ACCEPT** capital letter with superscript (eg **I**ᵃ) as this implies that the alleles are co-dominant.
			parents both Hh ;		
			gametes H and h from both parents ;		H and h **AND** H and h **ALLOW** ecf from parental genotypes
			offspring genotypes correctly linked to phenotypes ;		Hh = Huntington's / affected, hh = normal / unaffected, HH = lethal **OR** crossed out **OR** missing **OR** 'does not develop' **DO NOT CREDIT** HH = Huntington's
			(probability) 66.7 / 67 ;	**5**	**ALLOW** error carried forward if they have HH as 'Huntington's' or 'affected'. **ACCEPT** 66.6

Question			Expected Answer	Mark	Additional Guidance
(b)			*Look for the ideas of ...*		*Points may be made by the use of example(s)*
		1	children too young to, make informed decision to be tested / let them choose **;**		**ACCEPT** 'child may not want to know / parents are making a decision for them'
		2	not essential to be tested until they consider having children **;**		
			if tested…….		
		3	parents may not want to disclose result but child may want to know **;**		
			if result is positive		
		4	could lead to, psychological problems / low self esteem **;**		**ACCEPT** a description eg depression / self harm
		5	cannot do anything about it / there is no cure **;**		
		6	may have to declare it to outside agencies **;**		eg insurance companies / employers
		7	may lead to discrimination by, friends / family / school **;**		look for idea that they would be treated differently by everyday contacts
			but if result is negative		
		8	could have a normal life **;**		**LOOK FOR** reverse argument eg 'if test is positive then life will revolve around their illness / could affect life choices such as having children / allows time to prepare'
		9	could stop them worrying unnecessarily **;**	**4 max**	**DO NOT CREDIT** 'parents may decide not to have children' **OR** 'parents may have pregnancy terminated' as the question is about parents, who know they carry the Huntington's allele, having their existing children tested.

Question			Expected Answer	Mark	Additional Guidance
(c)	**(i)**		more triplets results in, larger proteins ;		**ACCEPT** 'longer protein'
			mass / AW, of protein builds up, faster ;	**2**	
	(ii)		ribosomes / RER /		
			rough endoplasmic reticulum ;	**1**	
	(iii)		forming a <u>peptide</u> bond ;		**DO NOT CREDIT** if given in a list
					IGNORE co-valent bond
			by a <u>condensation</u> reaction/ H and OH / water / H_2O, removed ;		
			(water) from carboxyl group and amine group ;		
			(by) enzyme / ribozyme ;	**2 max**	
(d)	**(i)**				**DO NOT CREDIT** 'message' but allow ecf to second marking point made
			axon carries, (nerve) impulse / action potential, away from cell body ;		
			dendrite carries, (nerve) impulse / action potential, towards cell body ;	**2**	
	(ii)		cell body ;	**1**	
	(iii)		no (essential) protein synthesis ;		**DO NOT CREDIT** 'no synthesis of amino acids'
			(such as) enzymes / transport proteins / AW ;		**CREDIT** a cytoskeleton protein eg tubulin
			no, metabolism / named metabolic process ;		eg respiration / active transport linked to protein
				2 max	**CREDIT** 'no mitosis' if linked to cytoskeleton protein
			Total	**19**	

Question		Expected Answer	Mark	Additional Guidance
5	**(a)**	200 % ; ;		actual size of pupil dilated = 9 mm (18 ÷ 2) [÷ 2 because photograph magnification is x2] 9 − 3 = 6 (6 ÷ 3) x 100 allow 1 mark for 500 % (since candidate has not allowed for the magnification of the image) allow ecf for incorrect measurement of W $\frac{(a / 2) - 3}{3}$ x 100
			2	

	(b)	sclera ;
		
		protects structures within eye /
		     maintains shape of the eye /
		     provides attachment for extrinsic eye
		                              muscles ;
			2	**ACCEPT** phonetic spelling

	(c)	tick against aqueous humour ; tick against cornea ;		<table><tr><td>feature</td><td>tick</td></tr><tr><td>retina</td><td></td></tr><tr><td>aqueous humour</td><td>✓</td></tr><tr><td>iris</td><td></td></tr><tr><td>cornea</td><td>✓</td></tr><tr><td>lens</td><td></td></tr></table>
			2	If more than 2 ticks in the table = 0 marks
		Total	**6**	

Question			Expected Answer	Mark	Additional Guidance
6	**(a)**		restriction, enzyme / endonuclease **;** sticky ends **;** plasmid **;** (DNA) ligase **;**	**4**	**IGNORE** 'vector'
	(b)	**(i)**			Mark the first 2 responses Assume candidates are referring to hamster cells unless otherwise stated Allow ora for statements referring to bacterial cells **IGNORE** reference to prokaryotic and eukaryotic as the question is asking for structural differences
			hamster cells / cells which produce EPO have: chromosome(s) **;** nucleus **;** larger / 22nm / 80S , ribosomes **;** membrane bound organelles **;** named organelle **;** *hamsters do not have:* plasmids **;** cell wall **;** pili **;** flagella **;**	**2 max**	eg mitochondria, endoplasmic reticulum, golgi **DO NOT CREDIT** ribosome for this mark

Question			Expected Answer	Mark	Additional Guidance
		(ii)	glycoproteins produced in golgi apparatus ; bacterial cells do not have golgi apparatus ; EPO gene may have introns ; bacterial DNA has no introns ; no editing possible (in bacterial cells) ;	2 max	**ACCEPT** idea that the protein made needs to be modified in the Golgi

	(c)		no / less, EPO produced by kidneys ;
			     EPO, stimulates red blood cell production /
			                                       prevents anaemia ;
			
			 less risk of transfer of, pathogens / viruses ;
			 GM EPO identical to HEPO / AW ;
				2 max	**ACCEPT** idea that red blood cell numbers will be low if EPO not given

			Total	10	

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance
programme your call may be recorded or monitored