OCR
Oxford Cambridge and RSA

GCE

Human Biology

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

Advanced GCE

Mark Scheme for June 2014

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

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
BP	**Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.**
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
R	reject

Question			Answer	Mark	Guidance
1	(a)		**B** cerebellum **;** **C** medulla (oblongata) **;**	2	**Mark the first answer in each box**. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer **= 0 marks** **ACCEPT** 'brain stem / hind brain'
	(b)	(i)	*idea of* an automatic / fixed pattern, response **;** (given) stimulus / described **;** blink (reflex test) / pupil response (reflex test) / knee jerk (reflex test) / AW **;**	3	e.g. a stereotypical or unlearned or involuntary response or look for the idea that the response has a form that is always predictable e.g. light shone in eye, striking the patellar tendon **IGNORE** a general description of a reflex arc which is not in the context of *testing* a reflex
		(ii)	(left) cerebral hemisphere / (left side of) cerebrum / (left) frontal lobe / Broca's area **;**	1	**ACCEPT** '(left side of) A' '(left side of) fore brain' **IGNORE** left side of brain / left side unqualified **IGNORE** parietal lobe
	(c)	(i)	(plasmin is) an enzyme / globular protein **;** breaks down / digests / AW, fibrin **;**	2	**CREDIT** hydrolysis of fibrin **IGNORE** ref to 'anticoagulant' **ACCEPT** (as ecf) mechanism for anticoagulant e.g. removal of calcium ions or (COX) enzyme inhibitor
		(ii)	eukaryotic cell / named eukaryotic (animal) cell **;**	2	**CREDIT** named eukaryotic cell line e.g. Chinese hamster ovary cells

Question			Answer	Mark	Guidance
			(glycoprotein) needs Golgi (apparatus) to , modify / add sugars to, protein **OR** prokaryotic cells do not have Golgi apparatus **;** AVP **;**		**ACCEPT** 'stem cells' **DO NOT CREDIT** 'bacteria' or 'prokaryotic' for mp1 but allow 'ecf' for mp 2 (as in AVP) e.g. ease of growing in laboratory, rapid growth rate, can take up plasmids (for prokaryotic cells)

Question			Answer	Mark	Guidance
		(iii)	33 **; ;**	2	**Correct answer = 2 marks** If answer is incorrect: **Award one mark** for correct calculation of weight (67.5 ÷ 0.9 =75) **OR** for a BMI given as 33.3(3333333.....) **OR** for correct BMI calculated from an incorrect body weight (e.g. a body mass divided by 2.25 (height in metres squared) (given to the nearest whole number)
		(iv)	*for body mass calculated above 30* *idea that* (BMI means that, Mrs G is) obese / obesity is a risk factor **;** (risk of) high blood pressure / high (blood) cholesterol / atherosclerosis / described **;** *for body mass calculated less than 25, applying ecf* another risk factor (other than BMI) may have contributed to stroke **;** (*for any body mass calculation)* example of other risk factors (independent of BMI) **;**	2	**CREDIT** reference to 'overweight' rather than obesity if BMI was calculated to be between 25 and 30 **IGNORE** reference to overweight (other than in above statement) **ACCEPT** (risk of) diabetes **ACCEPT** idea that this BMI does not pose an increased risk e.g. smoking / used HRT / age / family history

Question			Answer	Mark	Guidance
	(d)	(i)	*idea that* unable to remember what, has just happened / is currently happening **;**	1	**CREDIT** a description such as 'can't remember things from a few days ago'
		(ii)	have a calendar so patient can keep track of days **;** leave reminder notes around **;** place a selection of objects on a tray, cover them and ask them to remember **;** show patient recent photos to remember people / photos of current celebrities from magazines / AW **;** repetition of activities **;** AVP **;**	2	**ACCEPT** *idea of* 'cues' or 'prompts' **ACCEPT** Kim's game or a similar memory game described **CREDIT ONCE ONLY** references to showing photos or images as the question asks for different techniques
			Total	**17**	

Question			Answer	Mark	Guidance
2	(a)	(i)	Islet(s) of Langerhans **;**	1	**ACCEPT** upper or lower case, phonetic spelling
		(ii)	beta / β (cells) **;**	1	

Question	Answer	Mark	Guidance
(b)	**1** **(**gene(s) for hormones) transcribed / AW, in nucleus **;** **2** hormones / polypeptide / protein / synthesised, on ribosomes **;** **3** (ribosomes / proteins synthesised / translation) on RER **;** **4** hormones / polypeptides / proteins, transfer to Golgi (apparatus) **;** **5** (golgi) packages / AW, hormones into vesicles **;** **6** vesicles, fuse with / AW, cell surface membrane / hormones released by exocytosis **;** **7** mitochondria provide, energy / ATP, for (named) process **;** **8** (hormones) soluble in blood / transported in, blood / plasma **;** **9** (targets) muscle / liver **;** **10** ref to (hormone binding to) receptors on cell surface / plasma, membrane (of cells in target tissues) **;**	7	**ACCEPT** hormone / named hormone / polypeptide for mps 1.2.3. and 4 **1** **ACCEPT** a description of transcription such as 'mRNA (for hormones) being synthesised' **2. ACCEPT** mRNA translated on ribosomes or a description **DO NOT CREDIT** if exocytosis is given as part of a list **7** **CREDIT** this mark if linked to any process from mp 1,2.,4, 5 **DO NOT CREDIT** 'produce energy' **DO NOT CREDIT** as part of a list with other non-target organs
	QWC ;	1	**Award if:** mp **8 and 9** have been awarded **plus** any **two** from mps **1,3,5,6,7**
	Total	**10**	

Question			Answer	Mark	Guidance
3	(a)		Huntington's (disease) ; PKU / phenylketonuria ; haemophilia ; nail patella syndrome ; muscular dystrophy / DMD ; thalassaemia ; AVP ; ;	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 **= 0 marks** **IGNORE** 'colour blindness' **DO NOT CREDIT** Turner's syndrome / Down's syndrome / Klinefelters syndrome
	(b)	(i)	*Idea that* (disease is) always present in, a population / region ;	1	
		(ii)	**1** malaria acts as a selection pressure ;	4	**ACCEPT** correct use of 'selection' by malaria / Plasmodium

Question			Answer	Mark	Guidance
			2 mechanism of resistance described **;** **3** heterozygotes / carriers / sickle cell trait / Hb^sHb^A, (are) less likely to get malaria / more likely to survive / have an advantage **;** **4** sickle cell / advantageous, allele, is passed on in, reproduction / gametes **;** **5** homozygous 'normal' individuals / Hb^AHb^A , (more likely to) die from malaria **;** **6** homozygous for sickle cell /Hb^sHb^s , (more likely to) die from (sickle cell) anaemia **;**		**ACCEPT** idea that parasite / plasmodium / malaria, stays in the body for longer so immunity is enhanced **ACCEPT** 'those with (one) sickle cell allele' **NOTE** 'Those having a sickle cell allele have a selective advantage if malaria is present' = **2 marks** (**1** and **3**) **ACCEPT** 'those with no sickle cell allele' for homozygous normal
	(c)	**(i)**	gene, only enters cells lining lungs / does not enter all cells / not in sex cells **;** (gene) is not passed on to, next generation / offspring **;** this is not germ line therapy **;**	2	

Question			Answer	Mark	Guidance
		(ii)	DNA will not cross (cell surface / plasma) membrane **;** as molecule is too large **OR** molecule is hydrophilic / water soluble **;** liposome fat globule can, cross / fuse with, cell surface membrane **;**	2	**ACCEPT** ' phospholipid bilayer' **CREDIT** the reverse argument e.g. molecule is not small enough / is not fat soluble **CREDIT** idea that endocytosis can happen
	(d)	(i)	gene (on chromosome 7) has exons and introns **;** *idea that* (final) mRNA, has <u>introns</u> removed **;** (final) mRNA / cDNA (gene) , only has <u>exons</u> **;** (because) no enzyme in bacteria to, remove introns / edit mRNA **;**	2	

Question			Answer	Mark	Guidance
		(ii)	**1** (plasmid is) cut using, restriction enzyme / endonuclease **;** **2** (restriction enzyme) hydrolyses / AW, phosphodiester bond / sugar phosphate backbone **;** **3** enzyme binds to / AW, palindromic sites / specific recognition sites **;** **4** (restriction enzyme) gives plasmid complementary sticky ends (to those on CFTR gene) **;** **5** plasmid and CFTR gene (sticky ends) anneal / hydrogen bonds form between (complementary) base pairs **;** **6** DNA ligase used to seal up (sugar phosphate) backbone **;** **7** (ligase) condensation reaction / forms phosphodiester bond / joins the sugar phosphate backbone **;**	4	
			QWC ;	1	**Award if the following mps are awarded** mps **1 and 2** **OR** mps **6 and 7**

Question			Answer	Mark	Guidance
	(e)		(introduced) DNA / CFTR gene, broken down in cytoplasm **;** (DNA broken down) by lysosomes **;** *idea that* mitosis occurs in epithelial cells / epithelial cells will be dividing **;** (introduced) DNA / CFTR gene, not, replicated / copied (during interphase) **;** CFTR gene not present in daughter cells **;**	2	**ACCEPT** description of cells in lining of airways or lungs **CREDIT** reverse argument 'only genome is copied' **DO NOT CREDIT** ref to DNA replication in mitosis
	(f)		virus stimulates, an immune response / antibody production **;** *idea that* second / subsequent, doses produce greater amounts of antibodies **;** *idea that* antibodies, bind to virus / stops it entering the cell **;**	2	**CREDIT** correct reference to secondary immune response
			Total	**22**	

Question			Answer	Mark	Guidance
4	(a)	(i)	*visual acuity* how clearly / AW, objects can be seen **;** **plus up to 3 marks from the following** use a Snellen chart / AW **;** patient sits at a fixed distance and reads letters **;** the smaller the letter read the greater the visual acuity **;** AVP **;**	**4**	**ACCEPT** 'how clearly you can see' 'how much detail you can see' **IGNORE** references to focussing or accuracy **ACCEPT** a description of a chart **CREDIT** reference to 6m or 20 feet for distance e.g. one eye at a time, ref to 20/20 or 6/6 as 'very good'
		(ii)	idea that (more) cone cells lost (which are responsible for visual acuity) **;** macula / fovea, contains largest number of cone cells / region of concentrated cone cells ; *idea that* a single individual cone cell links to one ganglion cell **;**	**2**	**ACCEPT** no cone cells outside macula ***/*** only rod cells outside macula

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>
<table>
<tr><th>Term</th><th>Tick one response</th></tr>
<tr><td>the data is 95% accurate</td><td></td></tr>
<tr><td>the validity of the data is 95%</td><td></td></tr>
<tr><td>the confidence limits of the data are 95%</td><td>✓</td></tr>
</table>
;
</td><td>1</td><td>DO NOT CREDIT if more than one box has been ticked
DO NOT CREDIT hybrid ticks</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>increase in incidence is (very) similar in men and women
OR
the incidence is (slightly) lower in males than females, over the age of 71 / ORA ;

data quote with (for incidence) in support ;

reliability (of estimate) decreases with age ;

estimates (for men and women) show (very) similar reliabilities / described ;</td><td>3</td><td><table><tr><th>Age</th><th>Incidence per 1000
4.1a Males</th><th>Incidence per 1000
4.1b Females</th></tr><tr><td>50</td><td>0</td><td>0</td></tr><tr><td>60</td><td>2</td><td>2</td></tr><tr><td>70</td><td>3</td><td>3</td></tr><tr><td>75</td><td>(4 to 5)</td><td>(5 to 6)</td></tr><tr><td>80</td><td>8</td><td>10</td></tr><tr><td>85</td><td>14</td><td>16</td></tr><tr><td>90</td><td>24</td><td>26</td></tr><tr><td>95</td><td>(42-43)</td><td>46</td></tr><tr><td>96</td><td>50</td><td>54</td></tr></table></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>number of men and women in population (for each age group)
;</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(In 4.2) numbers decline due to deaths (in those age groups) ;

idea that death rate in men is higher than women / women tend to live longer than men ;

(so) same incidence results in more cases in women / fewer in men ;</td><td>2</td><td></td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td></td><td>2</td><td>One mark for named factor and one for correctly linked</td></tr>
</table>

Question			Answer	Mark	Guidance
			Factor smoking / obesity / high altitude / sickle cell anaemia / (familial) hypercholesterolaemia / high blood pressure **;** *Explanation* increases risk of, atherosclerosis / AW, *(for smoking / obesity / hypercholesterolaemia / high blood pressure)* **OR** carbon monoxide (in tobacco smoke) reduces oxygen transported by haemoglobin (*smoking*) **OR** lung damage reduces, gas exchange / uptake of oxygen (*smoking*) **OR** less haemoglobin saturation (in lungs) (*high altitude*) **OR** fewer red blood cells to transport oxygen (*sickle cell anaemia*) **;**		**explanation.** **IGNORE** ref to Diabetes **ACCEPT** 'high blood cholesterol' or 'high LDL' for hypercholesterolaemia **CREDIT** alternative biologically correct explanations for a named factor (one mark for factor and one for explanation). **ACCEPT** idea of less oxygen transported by red blood cells
		(ii)	variable / complementary, region / AW, binds to VEGF **;** VEGF no longer, fits / is complementary to, membrane receptor **;** **OR** antibody , binds to / AW, receptor for VEGF **;** (antibody) blocks receptor / prevents binding of VEGF **;**	2	**ACCEPT** idea that antibody has same shape as the VEGF receptor (as this implies it is complementary) **ALLOW** ref to binding site for variable region. **IGNORE** references to the active site

Question			Answer	Mark	Guidance
	(e)	(i)	(treatment) improves visual acuity, (within 3 months) / AW **;** (treatment) prevents decline of visual acuity / improvement is maintained / AW **;**	2	**CREDIT** idea that visual acuity declines with placebo
		(ii)	size of samples **;** same test of visual acuity **;** ref to double blind trial / randomised design **;** AVP **;**	1	**Mark the first answer**. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer **= 0 marks** e.g. gender balance (between groups) e.g. not having any other treatment e.g. age profile similar (in both groups) e.g. ethnicity profile similar e.g. size of doses / how often treatment was given
			Total	**20**	

Question			Answer	Mark	Guidance
5	(a)		(because) they contain, group of / more than one type of / different / tissue(s) **;** (because) they remove urea / metabolic waste / nitrogenous waste / product of amino acid breakdown **;**	2	
	(b)	(i)	**T** glomerulus **;** **U** Bowman's / renal, capsule **;** *region* (renal) cortex **;**	3	**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 **= 0 marks** I**GNORE** ref to nephron
		(ii)	ions **;** ascending **;** water potential **;** medulla **;** permeable **;** osmosis **;**	6	**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 **= 0 marks** **DO NOT CREDIT** 'and potassium' as this implies it is the metals that are transferred rather than the ions '

Question			Answer	Mark	Guidance
	(c)	**(i)**	volume increases **;** **plus any two from** glucose (in filtrate) lowers water potential **;** (leading to) reduction in water potential gradient (between the filtrate and the cortex) **;** less water reabsorbed (by osmosis), from descending limb / at X **;**	3	I**GNORE** ref to urine **ACCEPT** less water moves out (of loop) / less water leaves the filtrate
		(ii)	*idea that* (condition is inherited so will assess) risk of passing disease to, children / AW **;** advise on, (genetic) testing / alternatives to having (own) children **;**	1	**IGNORE** 'this is a genetic disease' as this is implied by the question **ACCEPT** 'children could inherit the disease' as this implies a 'risk'
			Total	**15**	

Question			Answer	Mark	Guidance
6	(a)		*osteoarthritis* degeneration of cartilage at joints / wearing of bones at joints due to loss of cartilage **;** *osteoporosis* loss of bone density / AW **;**	2	
	(b)	(i)	(in Africa) idea that people die younger but DALY is (still) high **;** (Africa and North America) comment on the magnitude of the difference in life expectancy and DALY **;** Use of data in support of either statement **;**	2	**ACCEPT** idea that the DALYs are (fairly) close but there is a larg(er) difference in life expectancy **CREDIT** calculations e.g. (Africa) DALYs (about) 18% less whereas life expectancy (about) 32% less **OR** Life expectancy in Africa is 68% of that in North America but DALYs are 81.7% **IGNORE** references to raw data
		(ii)	(due to) more, manual labour / agricultural work / AW, in population **;** *idea that* start working as (young) children **;** more walking / poor foorwear **;** lack of (sufficient) protein/vitamin C, in diet **;**	2	**IGNORE** reference to more exercise or active lifestyle (choice) **IGNORE** general reference to malnutrition **IGNORE** ref to aluminium (as this is linked to osteoporosis)
		(iii)	osteoporosis, data / figures / AW, varies with gender **;**	2	**CREDIT** idea that it will be higher in females than males

Question			Answer	Mark	Guidance
			ref to effect of menopause **;** ref to validity**;**		**DO NOT CREDIT** if given as part of a list
			Total	**8**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>
<table>
<tr><th>Term</th><th>Insert a tick</th></tr>
<tr><td>Genetic engineering</td><td></td></tr>
<tr><td>Therapeutic cloning</td><td>✓</td></tr>
<tr><td>Reproductive cloning</td><td></td></tr>
<tr><td>ICSI</td><td></td></tr>
<tr><td>IVF</td><td></td></tr>
</table>
;
</td><td>1</td><td>DO NOT CREDIT if more than one box has been ticked
DO NOT CREDIT hybrid ticks</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>embryonic / pluripotent ;</td><td>1</td><td>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks

ALLOW totipotent / multipotent
IGNORE omnipotent</td></tr>
</table>

Question			Answer	Mark	Guidance
		(ii)	mark in any order can (continue to) divide **;** pluripotent **OR** able to differentiate into / AW, (several) different types of, cells / tissues **;** *idea that* have same antigens as patient / will not be rejected (by patient's immune system) **;**	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 **= 0 marks** **IGNORE** 'totipotent'
			Total	**4**	

Question			Answer	Mark	Guidance
8	(a)		*part of nervous system* central / CNS **AND** *exact location* hypothalamus **;**✓	1	**Both** correct answers required for the mark
	(b)	(i)	to maintain blood, pressure / AW **;** AVP ;	1	 e.g. increase in respiration rate (due to temperature increase) so more oxygen required e.g. ref to sympathetic nervous system (also) causes increase in heart rate
		(ii)	 (core body) temperature falls **;** dehydration **;** thirst **;** drop in water potential (in blood) **;**	1	**Mark the first answer**. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer **= 0 marks** **IGNORE** refs to increase in breathing rate
	(c)		*idea that* in cyclical HRT progesterone is not given every day **;**	1	**CREDIT** explanations using reverse argument e.g. an implant would release hormones continuously
			Total	**4**	

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