OCR
RECOGNISING ACHIEVEMENT

GCE

Human Biology

Advanced GCE

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

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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Question			Answer	Marks	Guidance
1	(a)		(organ) pancreas **;** beta / β (cells) **;** alpha/ α (cells) **;**	**3**	**IGNORE '**islets of Langerhans' **IGNORE** 'endocrine cells' **IGNORE** reference to any hormones
	(b)		binds / AW, to receptors **;** (on) cell surface / plasma, membrane **;** (of) liver / muscle (cells) **;** detail **;** uptake of glucose increases **;** more glucose transport proteins (inserted in plasma membrane) / increased permeability (of plasma membrane) to glucose **;** *(promotes)* conversion of glucose to glycogen / glycogenesis **;** glucose respiration (increased) **;** (more) glucose converted into lipids / AW **;** inhibits, glycogenolysis / gluconeogenesis **;**	**5 max**	**ACCEPT** 'attach' **IGNORE** 'fat cells' **CREDIT** e.g. second messenger / cyclic AMP, reference to specificity / complementary Look for idea of 'more' glucose taken up **DO NOT CREDIT** 'insulin converts glucose to glycogen' **CREDIT** 'respires glucose rather than fats'

Question			Answer	Marks	Guidance
	(c)	(i)	points represent / AW, mean (insulin level at each glucose concentration) **;** (bars represent) reliability / spread (of data) **;**	 **2**	**ACCEPT** 'average' **DO NOT CREDIT** 'mean glucose concentration' **ACCEPT** range / distribution / variation / (+/- 1) standard deviation **DO NOT CREDIT** references to precision and accuracy

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(c)</td><td>(ii)</td><td>as glucose concentration increases, insulin secretion increases (in both pregnant and non-pregnant women) ;

both have, steepest / AW, increase between, 4 and 8 mol dm^{-3} / both level out between 8 and 20 mmol dm^{-3} ;

insulin (secretion) always higher in pregnant ;

difference gets larger as blood glucose concentration increases (up to 8 mol dm^{-3}) ;

figs in support ;</td><td>3</td><td>CREDIT reverse argument

Look for the idea that the GAP gets wider or bigger OR steeper rise in pregnant

value(s) for glucose with units and 2 values for insulin – accept ‘units’ for insulin

<table>
<tr><th>Blood Glucose (mol dm^{-3})</th><th>Non Pregnant (a.u.)</th><th>Pregnant (a.u.)</th></tr>
<tr><td>2</td><td>1.2</td><td>3.8</td></tr>
<tr><td>4</td><td>1.9 (2.0)</td><td>5.1 (5.2)</td></tr>
<tr><td>6</td><td>4.1 (4.2)</td><td>9.8</td></tr>
<tr><td>8</td><td>6.0</td><td>10.5 (10.6)</td></tr>
<tr><td>20</td><td>7.9 (8.0)</td><td>11.9 (12.0)</td></tr>
</table>
</td></tr>
</table>

Question			Answer	Marks	Guidance
		(iii)	*advantage* fetus receives, enough / AW, glucose **or** fetal nutritional needs met even if mother is malnourished **;** *explanation* (insulin) does not increase glucose, uptake / use (in maternal cells) **;** **or** fetal growth rate requires high levels of, ATP / respiration of glucose **;**	**2**	idea that fetal nutrition needs are met / fetus gets more glucose **DO NOT CREDIT** 'fetus gets glucose' alone **DO NOT CREDIT** cells insensitive to insulin as this has been given in the stem of the question look for the idea that high fetal growth rate will need high levels of glucose metabolism

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(d)</td><td></td><td>
similarities / both are

non-insulin dependent ;
pancreas / AW, still secretes insulin ;

target tissues, unresponsive to insulin / AW ;
not juvenile onset / AW ;
raised blood glucose / glucose in urine ;

up to 4 max
differences

<table>
<tr><th>Type 2</th><th>gestational</th><th></th></tr>
<tr><td>mature onset</td><td>due to pregnancy</td><td></td></tr>
<tr><td>due to obesity
overweight</td><td>due to pregnancy</td><td>;</td></tr>
<tr><td>males and females</td><td>female only</td><td>;</td></tr>
<tr><td>due to high, fat /
sugar, diet</td><td>due to pregnancy</td><td>;</td></tr>
<tr><td>long lasting</td><td>temporary</td><td>;</td></tr>
</table>
up to 4 max
</td><td>5 max</td><td>
ACCEPT idea that not treated by insulin injections
IGNORE references to both controlled by diet and exercise

ACCEPT ‘insulin insensitive’ idea
CREDIT reference to mature onset once only

for the differences, a <u>comparison</u> between Type 2 and gestational must be made
CREDIT any point (s) from first column with any point(s) in second column
ACCEPT due to, hormone / HPL for gestational
‘Type 2 diabetes is caused by high fat diets and is long lasting while gestational diabetes only occurs in pregnancy’ gets 2 marks
</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>20</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
2	(a)				**ACCEPT** ACh for acetylcholine throughout
		1	ACh / acetylcholine, is neurotransmitter **;**		
		2	calcium ions / Ca^{++} / Ca^{2+}, *enter*, presynaptic, neurone / AW **;**		**DO NOT CREDIT** calcium / Ca^{+} **IGNORE** Na+ for mp2
		3	(synaptic) vesicles / AW, containing ACh move to pre-synaptic membrane **;**		
		4	vesicles, fuse / bind with, presynaptic membrane **;**		
		5	exocytosis / ACh *released* **;**		
		6	ACh diffuses, across synaptic cleft **;**		
		7	ACh binds to, (complementary) receptors, on post synaptic membrane **;**		
		8	(chemical gated) ion channels open **;**		**ACCEPT** 'sodium channels'
		9	sodium ions *enter*, postsynaptic neurone **;**		
		10	post synaptic, membrane / neurone, depolarised OR action potential, initiated / AW **;**	**6 max**	direction of movement (in italics) must be clear for mps 2, 5 and 9
			QWC **;**	**1**	Award QWC if all 3 mps awarded.

Question			Answer	Marks	Guidance
2	(b)	(i)	(enzyme is) specific (to acetylcholine) **;** neonicotinoids will not, fit <u>active</u> <u>site</u> / form enzyme-substrate complex **;** neonicotinoids are a different shape to ACh **;**	**2 max**	**DO NOT CREDIT** answers which refer generally to Lock and Key **CREDIT** reverse argument '<u>active</u> <u>site</u> complementary to Ach' **DO NOT CREDIT** 'active site is same shape'
		(ii)	neonicotinoids remain, <u>attached to / AW</u> , receptors (on post-synaptic membrane) **;** ion channels remain open **;** constant depolarisation **;** nerve impulse / action potential, continually firing **;** neuromuscular junction affected **;**	**2 max**	**DO NOT CREDIT** neonicotinoids not broken down' as this is given in the stem **ACCEPT** idea that muscles keep being stimulated
	(c)	(i)	*independent variable* mass of insectide used / area of land treated with insecticide **;** *dependent variable* number of colonies / number of bees / mass of honey **;** *control variables* (comparable) weather / time period / crop / levels of varroa / species of bee / AVP **;;**	**4**	**ACCEPT** idea of known quantity of insecticide **ACCEPT** idea of known quantity of bees or honey Mark first answer only on each line. Ignore any subsequent correct answers, If a second answer is incorrect on each line = no mark (contradiction)

Question			Answers	Marks	Guidance
2	(c)	(ii)	fewer pollinators / less pollination ; loss of crop yield / AW ; loss of income to, farmer / producer ; effect on food chain ; aesthetic effects ; AVP ;	 2 max	Look for the *'idea of'* **CREDIT** a description e.g. organisms which feed on bees OR on plants that bees pollinate e.g. 'silent' gardens or countryside (no bees humming) / fewer flowers e.g. less bees wax OR loss of biodiversity
			Total	**17**	

Question			Answer	Marks	Guidance
3	(a)		*autosomal* (on) chromosomes 1 – 22 / not on sex chromosomes / not on X (or Y) chromosome **;** *recessive* only expressed in homozygote / two copies of the allele needed (for phenotype) / not expressed in heterozygote / not expressed in presence of dominant allele **;**	**2**	**DO NOT CREDIT** two copies of *gene* needed **IGNORE** 'only expressed if dominant allele is absent'
	(b)		parental genotypes Gg **;** gametes G and g from both parents **;** correct genotypes of children **;** correct phenotype matched to genotype **;**	**4**	**ACCEPT** other symbols if used correctly **DO NOT CREDIT** X and Y but penalise once only **ACCEPT** evidence for this mark from diagrams GG, Gg, (Gg) gg GG and Gg are normal **and** gg PKU **IGNORE** reference to carriers **ACCEPT** PKU trait as phenotype for Gg genotype

Question			Answer	Marks	Guidance
	(c)	(i)	coding regions (of DNA) **;** within the (PAH) gene **;**	**2**	Look for a statement that covers both mark points, such as 'the gene minus the introns' = 2 marks 'part of a gene which codes for amino acids' = 2 marks 'a section of DNA that codes for a protein' = 1 mark
		(ii)	*difference* (mRNA) shorter **;** fewer, nucleotides / triplets / codons **;** ***effect - max 2 from*** polypeptide chain / protein, has fewer amino acids **;** polypeptide chain / protein, has change in primary structure **;** different tertiary structure / 3D shape **;** protein / PAH / enzyme, non-functional / AW **;**	**3 max**	**DO NOT CREDIT** fewer bases **ACCEPT** protein has fewer amino acids **ACCEPT** protein has different primary structure **ACCEPT** 'different amino acid sequence' **CREDIT** PAH active site is a different shape / does not complement the substrate as two marks **ACCEPT** idea that protein will not work

Question			Answer	Marks	Guidance
3	(c)	(iii)	C (cytosine) is replaced by G (guanine) ; in GCC ; **OR** C (cytosine) is replaced by T (thymine) ; in GCT ;	2	**CREDIT** GCC becomes / AW, GGC ;; GCT becomes / AW, GTT ;;
	(d)	1 2 3 4 5 6 7 8	<u>natural selection</u> ; more mould in Europe / AW ; presence of mould / AW, acts as selection pressure ; in Europe heterozygotes / carriers, have advantage ; (heterozygotes) survive and reproduce ; pass on, advantageous / PKU, allele ; frequency of PKU allele increases in European population ; (Europe) PKU, identified / treated ;	5 max	**CREDIT** in Sub Saharan Africa carriers have disadvantage **CREDIT** heterozygotes less likely to survive and reproduce in Sub Saharan Africa **ACCEPT** 'people with a PKU allele' as idea of heterozygotes **CREDIT** frequency of allele decreases in Sub Saharan African population **CREDIT** so prevalence is lower in Sub Saharan Africa

Continued….

Question			Answer	Marks	Guidance
			QWC	**1**	Look for information quoted from the bullet points • prevalence rate for PKU in Europe is up to 10 times higher than that in areas such as Sub-Saharan Africa • individuals who carry the allele for PKU are known to be more resistant to a toxin produced by mould • mould is less common in dry regions such as Sub-Saharan Africa

	(e)		use sterile needle / lancet **;** swab the skin / heel **;** label samples **;** avoid contamination (between samples) **;** AVP **;;**	**2 max**	**DO NOT CREDIT** 'clean' alone **ACCEPT** 'sterile equipment' **CREDIT** reasonable suggestions **IGNORE** references to haemophilia
			Total	**21**	

Question			Answer	Mark	Guidance
4	(a)		central ; brain / spinal cord ; spinal cord / brain ; sensory ; somatic ; smooth ; bronchiole / bronchi / bronchus / trachea ; sympathetic ; parasympathetic ;	9	**CREDIT** these mp in either order but do not credit the same response twice **DO NOT CREDIT** 'spine' **ACCEPT** involuntary or visceral **DO NOT CREDIT** 'lungs'

Question	Answer	Mark	Guidance
(b)	*hearing* hearing loss / becoming deaf / AW **;** (due to) sensory hair cells / stereocilia **,** damaged / AW **;** in, inner ear / cochlea **;** detail of range of sound lost **;** *sight* loss of sight / becoming blind / AW **;** (due to) cataracts clouding the lens **;** Glaucoma damaging, optic nerve / blood vessels / causes tunnel vision **;** macular degeneration causes loss of **,** cone cells / central vision **;** loss of accommodation due to, less elastic, lens / (suspensory) ligaments **;** AVP **;**	**5 max**	**DO NOT CREDIT** 'hairs / stereocilia / neurones, die' **ACCEPT** sensory hair cells die e.g. high pitched sound lost OR speech difficult to pick out against background noise **DO NOT CREDIT** cause of damage alone e.g. loss of sight due to cataracts gets 1 mark but loss of sight due to cataracts clouding the lens gets 2 marks e.g. slower transmission in sensory neurones due to myelin sheath damage / diabetic retinopathy / ossicle damage / further detail of AMD or glaucoma
	Total	**14**	

Question			Answer	Mark	Guidance
5	(a)		to optimise rate of, metabolism / AW **;**		**ACCEPT** so cells work efficiently OR optimum temperature for enzymes OR enough ESCs form **DO NOT CREDIT** references to the body working efficiently **IGNORE** 'chemical reactions' unqualified
			below 37^{o}C		**ACCEPT** at lower temperatures
			diffusion rate is too slow **;** kinetic energy / AW, too low **;** less frequent / AW, collisions (between enzymes and substrates) **;**		**CREDIT** reverse argument e.g. 'at 37 there is enough kinetic energy'
			just above 37^{o}C proteins less stable **;**		**ACCEPT** at higher temperatures **IGNORE** protein denatures at high temperature
			denaturation, at very high temperatures **;**		**ACCEPT** 'temperature too high / too hot'
			idea that enzymes / antibodies / membrane protein / other named protein are essential **;**	**3 max**	Look for the idea that enzymes control key reactions such as respiration

Question			Answer	Mark	Guidance
	(b)	(i)	(ear) closest to / AW, core temperature / AW ; blood supply at same temperature as, brain / hypothalamus ; oral / skin temperatures, give lower readings ;	2 max	**ACCEPT** idea that skin temperature less accurate Look for reverse argument for ear temperature

		(ii)	other factors cause a loss of <u>mass</u> ; water (vapour) lost by exhalation ; (water lost by) urination / excretion / egestion / AW ; loss of mass by respiration of stored substrates ;	2 max	Looking for *reason* why mass has declined **DO NOT CREDIT** general statements such as 'water is lost by other means'

Question			Answer	Mark	Guidance
5	(c)		mass of sweat produced increases / they sweat more ; decrease in (mean) time to sweat onset / they sweat sooner ; (begin to) sweat at lower, ear / core, temperature ; less thyroxine produced (by day 9) ; figs for sweat loss OR time with units used in support of explanation ; figs for ear temp with units in support of explanation ;	4	

day	sweat loss (g)	ear temp (^{o}C)	time to sweating (mins)
1	540	36.55	8.8
2	580	36.60	9.2
3	640	36.55	8.8
4	680	36.65	8.4
5	720	36.40	6.4
6	700	36.35	6.0
7	760	36.40	5.2
8	820	36.30	5.6
9	840	36.30	5.8

	(d)		mental confusion ; headache ; muscle cramp ; low blood pressure ; tachycardia / AW ; dehydration ; nausea / vomiting ; dizziness / fainting ; AVP ;	3 max	e.g. physiological / psychological, distress / obviously suffering discomfort
			Total	**14**	

Question			Answer	Mark	Guidance
6	(a)	(i)	urea **;**	1	
		(ii)	144.32 **;;**	2	(13.01 / 9.015) x 100% Correct answer = 2 marks even if no working shown If answer is incorrect **or** not rounded **or** rounded incorrectly then allow 1 mark for correct working **ACCEPT** 83.83 **;;** (13.01/ 15.52) X 100% as this is the percentage <u>decrease</u> OR 518.33 **;;** (13.01 / 2.51) x 100% as this is the percentage <u>increase</u>
	(b)		(high protein) increase in amino acids **;** idea of excess (amino acids) **;** amino acids, deaminated / AW **;** in liver (cells) / hepatocytes **;** producing, ammonia / NH_3 **;** in ornithine cycle / combined with carbon dioxide **;** (ammonia) converted to urea **;**	4 max	**CREDIT** marking points on annotated diagram **ACCEPT** 'idea of amino acids which cannot be stored' for XS **CREDIT** 'amino / amine group removed from amino acid' **DO NOT CREDIT** ammonium **OR** 'ammonia ions'
	(c)		amino acids / proteins, are <u>respiratory</u> substrate / AW **;** with fewer , carbohydrates / lipids (in diet), more amino acids deaminated **; ora** (if more amino acids broken down) urea content would increase, in both diets **;**	2 max	**ACCEPT** idea of amino acids / proteins used in respiration Look for idea of a LOWER energy content INCREASES amino acid / protein breakdown OR HIGHER energy content DECREASING amino acid protein breakdown

Question			Answer	Mark	Guidance
6	(d)		(*diabetes) insipidus* **/** *mellitus* = ***NO MARK***		
			explanation must correspond with name		
			less water reabsorbed / (more) dilute urine **;**		
			reason **;**		*Diabetes insipidus* **CREDIT** lack of / less ADH OR absence of / faulty aquaporins in collecting duct OR lack of ADH receptors in collecting duct OR osmoreceptors in hypothalamus not functioning *Diabetes mellitus* **idea that** presence of glucose lowers water potential in glomerular filtrate
			increase in <u>volume</u> of urine **;**	**3 max**	
	(e)		carbon dioxide / CO_2 **;** (from) <u>aerobic</u> respiration / link reaction / Krebs cycle **;** **OR** water **;** from, electron transport chain / AW **;**	**2**	**DO NOT CREDIT** respiration alone
			Total	**14**	

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

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Facsimile: 01223 552553