



**General Certificate of Education
June 2010**

Human Biology

HBIO4

Bodies and cells in and out of control

Unit 4

Final

<i>Mark Scheme</i>

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Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	(a)		3 bases (in DNA / RNA) for 1 amino acid ;	1	
1	(b)		Formation of mRNA; Using RNA polymerase/complementary base pairing / using 1 strand of DNA as a template;	2	Accept description of complementary base pairing for last point Allow "copying"
1	(c)		mRNA + ribosome; Detail of structure, eg order of codons (on mRNA) determines order of amino acids/primary structure of protein/polypeptide; Reference to binding of codon (on mRNA) to anticodon on (tRNA)/ tRNA carries specific amino acid; Peptide bond formation / condensation / joining of amino acids;	2 max	Context - at ribosome

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	(a)		Colour detected by <u>cone</u> cells; Fovea contains (only/mainly) cone cells; <u>Three</u> types of cone/cells <u>described</u> / each sensitive to different wavelength/to red or green or blue;	3	Max 2 if 'rods' and 'cones' confused consistently
2	(b)	(i)	Each receptor (in fovea)/each cone connected to separate neurone / rods/cells in other parts share a neurone;	1	Accept nerve cell/nerve fibre
2	(b)	(ii)	Many rods in other parts of retina; Rhodopsin/pigment in receptors/rod cells very sensitive to light / works in low light; Receptors/rods connected in groups to ganglion cell/neurone; Summation; Description of summation, eg if enough light above threshold hits any cells in the group, then get nerve impulses to brain/along optic nerve;	3 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	(a)	(i)	1 / 2;	1	
3	(a)	(ii)	3 ;	1	
3	(a)	(iii)	G ;	1	Accept F
3	(b)	(i)	A , B , C , D , E ;	1	2 max
3	(b)	(ii)	Formed by meiosis; Independent assortment / random segregation / described / random alignment; Crossing-over / described;	2 max	Allow miosis/meosis Ignore phase
3	(c)		FSH / hCG / LH / GnRH agonist;	1	Accept 'Clomifene'

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	(a)	(i)	A;	1	
4	(a)	(ii)	H + I;	1	
4	(b)		<p>Correct answer: 7000;;</p> <p>OR</p> <p>1 sarcomere = $\frac{48}{16}$ (μm) and use of 21 (000) μm / use of $\frac{21}{3}$ (000) ;</p> <p>OR</p> <p>Allow for error re. interconversion of mm / μm:</p> <p>e.g. $\frac{21}{3}$ / $\frac{2100}{3}$;</p>	2	<p>Accept 6422 to 7608</p> <p>Ignore working</p> <p>Allow 1 mark</p> <p>Allow 1 mark</p>
4	(c)		<p>Rise in Ca^{2+} (in muscle cells) / Ca^{2+} enters (muscle cells) / Ca^{2+} from SR;</p> <p>Leading to movement of blocking/inhibiting molecules/troponin/tropomyosin;</p> <p>Expose binding sites on <u>actin</u>/on <u>thin</u> filament;</p> <p>Allow actin-myosin interaction / cross-bridge formation /allow myosin to bind /allow filaments to slide past each other;</p> <p>Activate ATP-ase (on myosin);</p>	3 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	(a)		Can control/spray herbicide on weeds among growing crop; Without harming crop; Weeds <u>compete</u> with crop / description eg for factor – water/light/ions; Weeds reduce yield of crop / use of herbicide increases yield;	2 max	
5	(b)	(i)	By reproduction/pollen/bacteria/named vector;	1	
5	(b)	(ii)	Mutation;	1	Accept via a vector OR By pollen/seeds carried long distances by wind/animals

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	(a)		Parents without CF → offspring with CF / 1 + 2 → 6 / 7 + 8 → 10; Each parent must have CF allele /offspring receives CF allele from both parents / both parents heterozygous / both carriers;	2	
6	(b)		Nn and Nn (no mark since awarded in 6(a) already) N n and N n ; NN and Nn and Nn and nn ; Correct allocation of phenotypes to genotypes; Probability = <u>0.125</u> ;	4	Accept alternative symbols Ignore X and Y Accept answers expressed as chance rather than probability, eg 1 in 8 /1 to 7 / 12.5%;

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	(a)		Oxytocin causes contraction of the (uterine) muscle/uterus;	1	
7	(b)		<p><u>For</u>:</p> <p>Pressure rise indicates going into labour; Barusiban lowers pressure in uterus;</p> <p><u>Against</u> (2 max): Monkeys might react differently from humans; Sample size not known/too small/need repeat; No statistical information; No control group injected with saline/given placebo; Might be side-effects;</p>	3 max	
7	(c)		<p>Suckling = <u>stimulus</u> / (pressure) <u>receptors</u> in nipple/ suckling → <u>impulses</u>;</p> <p>Via hypothalamus; <u>Pituitary</u> releases <u>oxytocin</u>; Release of oxytocin → contraction of (muscles in) milk ducts; (Release of) prolactin leads to milk produced (to be released);</p>	3 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
8	(a)		<p>Menstruation ceases / ovulation ceases;</p> <p>Emotional problems / mood swings / depression / irritability / loss of concentration/memory;</p> <p>Hot flushes;</p> <p>Sleeping problems;</p> <p>Vaginal dryness;</p> <p>Decreased sex drive;</p> <p>Osteoporosis/brittle bones;</p> <p>Urinary problems/infections / incontinence;</p> <p>More abdominal fat deposits/weight gain;</p> <p>Hair thinning;</p> <p>Rise in FSH/fall in progesterone/fall in LH;</p> <p>Increased chance of CHD / same risk as in men;</p>	2 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
8	(b)	(i)	<p>Yes (no mark) because: Oestrogen increases rate of cell division/mitosis; Cancer is due to (uncontrolled) cell division / increased chance of mutation with increased cell division;</p> <p>OR Uncertain because: Artificial <i>in vitro</i> experiment / conditions in the body may be different; Macrophages/immune system destroying cells / chemical processing of oestrogen ;</p>	2 max	<p>Eg in proto-oncogene/tumour-suppressor gene</p> <p>OR Methodology: Sample size not known/no repeats; Concentration of oestrogen relative to normal not known;</p>
8	(b)	(ii)	Ebselen reduces rate of cell division;	1	
8	(b)	(iii)	<p>Genetic differences between women / eg re. tumour-suppressor genes/oncogenes; Body has process to remove/control cancerous cells; Oestrogen may only act on cells that are already cancerous/pre-cancerous; Amount oestrogen given just restores to normal level; Oestrogen sensitivity may be linked to environmental ,eg smoking /physiological conditions; Mutations must occur before oestrogen has an effect;</p>	2 max	
8	(c)		<p>Oestrogen may lead to peroxide formation/release;</p> <p>Peroxides affect oncogenes/tumour-suppressor genes;</p> <p>Loss of control of cell division;</p>	2 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
9	(a)		Restriction enzyme / restriction endonuclease;	1	
9	(b)	(i)	A-G-C-T / T-C-G-A;	1	Allow A-G-C-T-T / T-T-C-G-A
9	(b)	(ii)	Joining two pieces of DNA; By <u>complementary</u> binding/ <u>complementary</u> base-pairing;	2	
9	(c)	(i)	4943;	1	
9	(c)	(ii)	3;	1	
9	(c)	(iii)	2 bands disappear / only 3 bands; New band formed at heavier position/nearer to origin/higher up;	2	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
10	(a)		<p>Correct answer: 6 / 6.25 / 6.3;;</p> <p>OR</p> $\frac{1000}{160} / \frac{1}{160} ;$	2	<p>Ignore working</p> <p>Allow 1 mark if decimal point in wrong position</p> <p>Allow 1 mark</p>
10	(b)		<p>Ref. to '<u>refractory period</u>';</p> <p>Requires greater stimulation; To reach threshold / threshold cannot be reached / to cause depolarisation;</p> <p>K⁺ channels are open / more negative potential than resting potential / membrane is hyperpolarised;</p> <p>Na⁺ channels are inactive/are closed / sodium channels will not open;</p>	3 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
11	(a)	(i)	Receptor/or insulin has specific shape/tertiary structure; (Has binding site) complementary to / shape that fits (that of insulin);	2	Reject "same shape"
11	(a)	(ii)	Glycogen;	1	
11	(a)	(iii)	Membrane has lipid/hydrophobic (bi-) layer; Glucose is not lipid-soluble/not hydrophobic / is hydrophilic/polar; Transporter spans the membrane; Transporter has water-filled channel; Ref. to diffusion/facilitated diffusion; Ref. to specificity of transporter/complementary shape;	3 max	Allow 'active transport'
11	(b)	(i)	Two suitable factors;; Examples: Sex (of patients); Amount/type of food/diet; Amount of exercise; BMI/body fat/mass; Ethnic group; Health;	2 max	Accept other sensible suggestions of control variables

Question	Part	Sub Part	Marking Guidance	Mark	Comments
11	(b)	(ii)	Type 2 diabetics have: Higher glucose; Higher insulin; Lower adiponectin/similar adiponectin; More variability / higher SD;	2 max	
11	(b)	(iii)	Range = just extremes / could be anomalous / atypical / non-representative values; Mean + SD: uses all values / shows spread about mean; Can calculate confidence limits / can be used in stats test;	2 max	
11	(c)	(i)	There is no (significant) difference between concentration of insulin in diabetics and in non-diabetics / any difference is due to chance;	1	
11	(c)	(ii)	There is a significant difference between diabetics and non-diabetics / difference is not due to chance (alone) / is unlikely to be due to chance / > 99% confident that results are not due to chance / reject the null hypothesis (assuming correct n.h. in (c) (i));	1	
11	(d)		As one parameter increases, the other decreases / there is an inverse relationship between the two parameters;	1	owtte

Question	Part	Sub Part	Marking Guidance	Mark	Comments
11	(e)		<p>Yes, because:</p> <p>Obese people have reduced adiponectin (Figure 7); Low adiponectin is associated with high insulin (Figure 8 and Figure 6); High insulin/low adiponectin found in type 2 diabetics (Figure 6);</p> <p>OR</p> <p>Accept converse statements No, because:</p> <p>Correlation may not be significant / broad spread of data; May be other contributory factor, eg lack of exercise; Correlation does not prove causal link;</p>	3 max	
11	(f)		<p>Type 2 diabetics have lower (blood) adiponectin; Low adiponectin (in blood) leads to fewer glucose transporters <u>in cell membranes</u>; Less glucose is removed from blood (→ higher blood glucose); High blood glucose detected by pancreas; High blood glucose stimulates release of more insulin (→ higher blood insulin);</p>	3 max	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
11	(g)		<p>N – has high activity / acts quickly;</p> <p>N – will lead to greater/faster lowering of blood glucose (than G);</p> <p>N – (relatively) short-lived effect;</p> <p>N – may need >1 injection per day;</p> <p>N – useful around meal times;</p> <p>G – fairly constant level of insulin (activity);</p>	4 max	Accept converse statements for G