Version 1.1



General Certificate of Education (A-level)
June 2012

Biology BIOL5

(Specification 2410)

Unit 5: Control in Cells and in Organisms

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: aqa.org.uk

Copyright © 2011 AQA and its licensors. All rights reserved.

Copyright
AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

Although specific marks are not awarded in questions 1-7, marks will take into account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and have used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to the quality of written communications are marked **Q** in this mark scheme.

SECTION A

Question	Marking Guidance	Mark	Comments
1(a)(i)	UGC;	1	
1(a)(ii)	TGCTAC;	1	
1(b)	(DNA) contains introns/non-coding bases / mRNA only contains exons/coding bases;	1	Assume that 'it' refers to DNA Neutral: DNA contains introns and exons Neutral: 'splicing' Neutral: pre-mRNA contains introns Ignore refs. to start and stop codons
1(c)	Different primary structure/amino acid sequence/amino acid coded for;	1	Reject: different amino acids produced/formed Neutral: refs. to bonds
1(d)	1. Acetylcholine not broken down / stays bound to receptor; 2. Na^+ ions (continue to) enter / (continued) depolarisation / Na^+ channels (kept) open / action potentials/impulses fired (continuously); 3. (Intercostal) muscles stay contracted / cannot relax;	3	3. 'Muscles contract' is not enough Accept: diaphragm stays contracted / cannot relax

Question	Marking Guidance	Mark	Comments
2(a)(i)	Decreases;	1	Accept any word that means a decrease e.g. shorter/narrower/ smaller etc
2(a)(ii)	Nothing / stays the same length / does not change;	1	
2(b)	1. Two marks for correct answer of 29545-30455; 2. One mark for incorrect answers in which candidate clearly divides measured width by actual width;	2	Correct answer = 2 marks outright. Range allows for a 1mm error in measuring Ignore rounding up
2(c)	(Idea ATP is needed for:) 1. Attachment/cross bridges between actin and myosin; 2. 'Power stroke' / movement of myosin heads / pulling of actin; 3. Detachment of myosin heads; 4. Myosin heads move back/to original position / 'recovery stroke';	3 max	1. Accept the role of ADP in attachment 2. Not just 'filaments slide' as given in the question stem

Question	Marking Guidance	Mark	Comments
3(a)(i)	1. LH increases/peaks after oestrogen increases/peaks; ***OR*** 2. Oestrogen increases/peaks before LH increases/peaks;	1	Need the idea of 'after' or 'before' Neutral: LH increases as oestrogen increases Neutral: oestrogen causes LH to be released as in stem of the question
3(a)(ii)	Progesterone falls / progesterone returns to start / progesterone not maintained;	1	Accept: FSH increases at end of the cycle
3(b)(i)	1. FSH inhibited; 2. Follicle not stimulated / ripened / does not grow; 3. LH inhibited; 4. Ovulation prevented / egg/ovum not released;	4	2. Accept: egg not ripened **Q** Neutral: egg/ovum not produced Only penalise if a <u>direct</u> incorrect statement is made e.g. LH inhibited so follicle not ripened = 1 mark FSH and LH inhibited so follicle not ripened and ovulation prevented = 4 marks
3(b)(ii)	Will not forget to take Implanon / may forget to take an oral contraceptive / does not have to be taken daily / not affected by illness/vomiting;	1	Neutral: ref. to lasting longer / acting quicker Neutral: 'constantly released' as given in the stem of the question Reject: oral contraceptives are digested Neutral: refs. to cost

Question	Marking Guidance	Mark	Comments
4(a)	1. (Oxygen/carbon dioxide) detected by chemoreceptors / (pressure) detected by baroreceptors; 2. Medulla/cardiac centre involved; 3. More impulses to SAN/along sympathetic nerve;	3	2. Accept a valid equivalent e.g. cardioacceleratory centre 3. Neutral: signals/messages Accept: acceleratory nerve Need idea of 'more impulses' directly, not by implication
4(b)(i)	1. To ensure results are due to omega-3/fatty acids (only) / not due to something else in the oil; 2. Placebo linked to mental/psychological effect;	1 max	Neutral: Idea of comparing groups/results Neutral: reference to a control group / placebo (unqualified)
4(b)(ii)	1. Lower/greater change of heart rate for Group **A**; 2. (Differences) are real / reliable / significant / not due to chance; 3. As bars do not overlap / values are not shared;	3	Ignore references to methodology

Question	Marking Guidance	Mark	Comments
5(a)	Restriction / endonuclease;	1	Ignore specific names of restriction enzymes e.g. EcoR1
5(b)(i)	1. (Acts as a) marker gene; 2. Shows that the (human) gene has been taken up/expressed; 3. (Only) implant cells/embryos that show fluorescence / contain the jellyfish gene;	2 max	1. Accept: gene marker
5(b)(ii)	1. Factor IX present in / extracted from milk; 2. Gene only expressed in mammary glands/udder / gene not expressed elsewhere; 3. Do not need to kill sheep (to obtain Factor IX);	2 max	2. Ignore references to milk The 'only' aspect is important here.
5(c)(i)	1. Mutation / nucleus/ chromosomes/DNA may be damaged / disrupts genes; 2. May interfere with proteins (produced)/gene expression/ translation; ***OR*** 3. Embryo/antigens foreign; 4. Embryo is rejected/attacked by immune system;	2 max	1. Neutral: cell may be damaged Ignore references to hormone levels or time of implantation 3. Neutral: antigens change 4. Need idea that the immune system is involved if mark point 3 has not been given 'Embryo foreign so rejected' = 2 marks 'Embryo rejected by immune system' = 1 mark 'Embryo is rejected' = 0 marks
5(c)(ii)	1. Saves time/money for others; 2. Same work is not repeated / methods can be compared/improved/ amended/ same errors are not made;	2	

Question	Marking Guidance	Mark	Comments
6(a)	1. Adenylate cyclase activated / cAMP produced / second messenger produced; 2. Activates enzyme(s) (in cell); 3. (So) glycogenolysis/ gluconeogenesis occurs / glycogenesis inhibited;	2 max	3. Neutral: 'glucose produced' as given in the question stem Accept: correct descriptions of these terms
6(b)(i)	1. Glucose/sugar in food would affect the results; 2. Food/eating would affect blood glucose (level); 3. (Allows time for) blood glucose (level) to return to normal;	1 max	1. Accept references to starch / carbohydrate 3. Neutral: allows time for insulin to act
6(b)(ii)	Type 2 diabetes is a failure to respond to insulin / still produces insulin / is not insulin-dependent;	1	
6(b)(iii)	(For) – 3 max 1. Avoids injections / pain of injections; 2. Long(er) lasting / permanent / (new) cells will contain/ express gene; 3. Less need to measure blood sugar / avoids the highs and lows in blood sugar; 4. Less restriction on diet; (Against) – 3 max 5. Rats are different to humans; 6. May have side effects on humans; 7. Long(er) term effects (of treatment) not known / may have caused effects after 8 months; 8. (Substitute) insulin may be rejected by the body;	4 max	A maximum of three marks can be awarded for each side of the argument Ignore references to methodology e.g. sample size not known 6. Accept: virus may be harmful / disrupt genes / cause cancer

Question	Marking Guidance	Mark	Comments
7(a)	1. (Seedlings) respond to light / are phototropic; ***OR*** 2. (Only) measuring the effect of gravity / response to gravity;	1	Reject: <u>roots</u> are positively phototropic / grow towards light Neutral: 'to control a variable' Neutral: light affects growth/results
7(b)	1. (Cells in) root tip detect gravity / respond to gravity; ***OR*** 2. IAA/auxin is produced in the root tip;	1	Must refer to root tip and not just the root
7(c)(i)	1. IAA/auxin moves to lower side / more IAA/auxin on lower side; 2. Lower side grows less/slower / upper side grows more /faster / inhibits growth on lower side;	2	Accept: references to 'cell elongation' instead of 'growth' Note: if auxin is placed at upper side, mark point 2 can still be awarded Need idea of 'less/slower' or 'more/faster' for mark point 2
7(c)(ii)	1. Less IAA/auxin (produced); 2. Lower side grows more/faster / less inhibition of growth on lower side;	2	2. Must refer to the lower side

Question	Marking Guidance	Mark	Comments
8(a)(i)	1. Negative correlation; 2. Wide range; 3. Overlap; 4. (Graph suggests that) other factors may be involved (in age of onset);	3 max	1. Accept: description for 'negative correlation' Neutral: 'correlation' Reject: positive correlation 2/3 Accept the use of figures from the graph 2/3 Can refer to age of onset or number of CAG repeats Ignore references to methodology
8(a)(ii)	1. Age of onset can be high / symptoms appear later in life; 2. (So) individuals have already had children / allele has been passed on; ***OR*** 3. Individuals have passed on the allele / already had children; 4. Before symptoms occur;	2 max	Accept: 'gene' for 'allele'
8(b)(i)	1. Person **K**; 2. (As has) high(est) band/band that travelled a short(est) distance/slow(er) so has large(st) fragment/number of CAG repeats;	2	2. Must correctly link distance moved and fragment size
8(b)(ii)	Run fragments of known length / CAG repeats (at the same time);	1	Accept: references to a DNA ladder / DNA markers Do not accept DNA sequencing
8(b)(iii)	Homozygous / (CAG) fragments are the same length/size/mass;	1	Accept: small fragment has run off gel / travelled further

Question	Marking Guidance	Mark	Comments
9(a)	1. 21 or 21.4; 2. One mark for the principle of difference/initial;	2	Correct answer = 2 marks outright Ignore number of decimal places
9(b)(i)	Water intake linked to sweating / panting;	1	Neutral: ref. to urine Neutral: dehydration
9(b)(ii)	1. Food intake linked to (increased) <u>respiration</u>; 2. Food intake linked to heat/energy release / maintaining body temperature;	2	1. Not 'increased metabolism' Reject: decreases respiration Neutral: references to environmental temperature increasing 2. This mark is independent of 1
9(c)	1. Increased sweating so less water available (for milk production); 2. Less food so less energy/nutrients available (for milk production); 3. Enzymes not working at optimum temperature;	1 max	2. Not just 'less energy available (for milk production)' 3. Reject: references to enzyme denaturation
9(d)	(Skin temperature) 1. Varies/fluctuates more / more heat lost/gained / (can be) further from core; 2. (As) more affected by environment / sweating / conduction / convection / radiation;	2	Accept: converse arguments for rectal temperature 2. Accept: 'not affected by' in relation to rectal temperature Accept: named environmental factors Accept: idea that skin is more exposed to the environment Accept refs. to vasoconstriction / vasodilation
9(e)	Select a bull whose mother/offspring produced a high milk yield;	1	

9(f)	1. Allows comparison; 2. (As) different countries have different population/ sample sizes;	2	
9(g)	1. (Selective) advantage producing lactase/ being lactose tolerant/able to digest milk/able to eat dairy foods; 2. People (producing lactase) reproduce; 3. (And) pass on gene/allele; 4. <u>Allele</u> frequency increases;	4	Accept: converse arguments for people who are lactose intolerant If mark point 2 has **not** already been given, then mark point 3 automatically gains 2 marks as reproduction must have occurred 4. Neutral: gene frequency increases / allele frequency changes Must be clearly stated and not implied

Additional notes on marking Question 10

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will be. In fact, extra credit is given for those who show evidence of a greater breadth of study. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

Question 10

Essay A - The importance of shapes fitting together in cells and organisms

Section	Topic
	Proteins & Enzymes
3.1.2	Enzyme properties and digestion
3.1.2	Protein structure
3.1.3	Plasma membrane structure and cell transport
3.1.6	Antigens, antibodies, B cells & T cells
3.1.6	Vaccines
	Nucleic Acids
3.2.2	Structure of DNA
3.2.5	DNA Replication (not PCR)
3.5.7	Transcription & translation
3.5.8	Transcriptional factors, oestrogen, siRNA
3.5.8	Restriction enzymes
	Physiology
3.2.4	Haemoglobin
3.5.2	Action potentials & synaptic transmission
3.5.3	Muscle contraction
3.5.4	Control of blood glucose concentration
3.5.5	Control of mammalian oestrous cycle

Question 10

Essay B - How bacteria can affect the lives of humans and other organisms

Section	Topic
	Bacteria & Disease
3.1.1	Pathogens
3.1.2	Lactose intolerance
3.1.3	Cholera
3.1.4	Tuberculosis
3.2.10	Resistance to antibiotics
	Ecological Importance
3.4.6	Carbon cycle
3.4.6	Nitrogen cycle
3.4.6	Eutrophication
	Making Use of Bacteria
3.5.8	Use of bacterial enzymes e.g. restriction endonuclease, DNA polymerase for PCR
3.5.8	Use of bacterial plasmids e.g. *in vivo* gene cloning, genetically-modified crops, gene therapy
3.5.8	Use of bacteria to produce useful chemicals