

INTERNATIONAL A-LEVEL **Biology**

BL04 - Control

Mark scheme

9610

June 2018

Version/Stage: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer 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 associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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

Question	Marking guidance	Mark	Comments
01.1	<p>Sodium <u>ions/Na⁺</u> actively transported/pumped out and potassium <u>ions</u> / <u>K⁺</u> in;</p> <p>Membrane more permeable to potassium <u>ions/K⁺</u></p> <p>or</p> <p>Membrane less permeable to sodium <u>ions/Na⁺</u>;</p>	2	<p>Accept: Na⁺ channels (stay) closed</p> <p>Accept: idea that sodium <u>ions</u> / <u>Na⁺</u> are actively transported/pumped out and (most) cannot diffuse back in for 1 mark</p> <p>Penalise omission of <u>ions</u> only once in relation to MPs 1 & 2</p>

<p>01.2</p>	<p>(Pressure causes) <u>membrane/lamellae</u> to become deformed/stretched;</p> <p>Sodium ion/<u>Na⁺</u> channels in membrane open and sodium <u>ions/Na⁺</u> diffuse/move in;</p> <p>Greater pressure means more sodium <u>ion/Na⁺</u> channels open;</p> <p>Inside of neurone becomes less negative/more positive (than outside);</p>	<p>3 max</p>	<p>Accept: bending as an equivalent to deformed/stretched (in correct context of the <u>membrane</u>)</p> <p>Accept: stretched mediated ion channels open and sodium ions diffuse/move in</p> <p>Accept: membrane becomes more permeable to sodium <u>ions/Na⁺</u> and sodium <u>ions/Na⁺</u> diffuse/move in;</p> <p>Accept: greater pressure means greater permeability to sodium <u>ions/Na⁺</u></p> <p>Accept: idea that potential increases Accept: idea of a <u>positive</u> increase in charge Ignore: reference to increase in charge Accept: idea that potential difference reduces/becomes less negative Ignore: references to action potential(s), generator potential(s) and depolarisation</p> <p>Penalise omission of <u>ions</u> only once in relation to MPs 2 & 3</p>
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01.3	Threshold (has been) reached; (Threshold or above) causes maximum response/reaction/depolarisation;	2	Reject: references to threshold frequency Accept: reference to <u>all or nothing</u> principle (in correct context)
01.4	Sketch to show same amplitude/height of action potential as in medium pressure graph for microelectrode S (just below +40mV); but of a greater frequency (more than 2 action potentials drawn); or 2 drawn but 2 nd one earlier	2	Accept: +/- ½ square tolerance in sketch Reject: if first sketched action potential is delayed/late than the original one shown Ignore: omission of refractory period/hyperpolarisation Look for 3 or more action potentials for 1 mark AND of same height as graph above the one candidate is annotating for second mark
01.5	0.7 (ms); OR 0.8 (ms); OR 0.9 (ms); OR 1 (ms);	1	Reject: answers given to more than one decimal place

01.6	<p>114.4;; (if 0.9 used in Q01.5) OR 128.8;; (if 0.8 used in Q01.5) OR 147.1;; (if 0.7 used in Q01.5) OR 103.0;; (if 1 used in Q01.5)</p>	2	<p>Correct answer based on ECF from candidate's response to Q01.5 scores 2 marks Correct answer with incorrect number of decimal places scores a maximum of 1 mark</p>
01.7	<p>Less/no saltatory conduction/action potential; More depolarisation over length/area of membrane/neurone/axon;</p>	2	<p>Accept: idea that impulse is unable to 'jump' from node (of Ranvier) to node (of Ranvier) / allow converse statement Accept: idea that impulse must pass through a greater amount of membrane/neurone/axon</p>
01.8	<p>Greater entry of sodium <u>ions</u> / Na^+ in non-myelinated neurone; Reference to active transport;</p>	2	<p>Accept: greater exit of potassium <u>ions</u> / K^+ in non-myelinated neurone Accept: reference to ion pump(s)</p>

Question	Marking guidance	Mark	Comments
02.1	Growth response; To (a) directional stimulus/stimuli;	2	Ignore: references to a direct stimulus Accept: towards or away from a stimulus Accept: directional response (to a stimulus) for a maximum of 1 mark
02.2	To prevent the growth of micro-organisms/bacteria/pathogens; (That could) prevent (seed) germination;	2	Insufficient: references to results being affected Insufficient: references to contamination by micro-organisms/bacteria/pathogens Accept: negative impact on (seedling) growth such as death/rot/limited growth
02.3	Sticks to agar, so that seeds do not fall off when plate is placed vertically; So that the seeds could still obtain oxygen/roots can still grow/not damaged;	2	Accept: references to seeds remaining in (a fixed) position Accept: idea that seeds are (still) able to respire <u>aerobically</u> / do <u>aerobic</u> respiration

02.4	<p>Grow in direction of/towards (pull of) gravity;</p> <p>Grow/move away from salt; Salt has more of an effect (than gravity);</p>	3	<p>Accept: tropism for growth throughout Ignore: references to bends/moves throughout Ignore: pulled by gravity Accept: positively geotropic/gravitropic</p> <p>Accept: negatively chemotropic/halotropic Accept: converse statement for gravity</p>
02.5	<p>Small sample size/not representative; Only one variety of tomato plant investigated;</p>	2	<p>Accept: idea that experiment has only been done once Accept: idea that not enough tests have been done Accept: other varieties of tomato plant may respond in a different way Accept: idea that (some) roots could interfere/disrupt other roots' growth Accept: references to distance of downward growth being very short</p>

Question	Marking guidance	Mark	Comments
03.1	<p>Potent – Potential/ability to differentiate into specialised/different cell types</p> <p>Immortal – Divide/multiply indefinitely/constantly (by mitosis)</p>	2	<p>Accept: can differentiate/develop into other cell types</p> <p>Accept: idea that cell can differentiate into any cell</p> <p>Accept: (they will) replace themselves/<u>carry on</u> dividing / <u>keep</u> replicating/multiply in numbers</p> <p>Accept: idea that cell can form many generations</p> <p>Ignore: live on to many generations</p> <p>Ignore: references to not dying out</p>
03.2	Totipotent and pluripotent	1	Fourth box ticked

03.3	<p>Idea of non-self antigens;</p> <p>Can cause an immune reaction (in patient);</p> <p>Unethical as embryos are destroyed/killed in the process;</p> <p>Limited/unreliable availability (of embryos);</p>	4 max	<p>Accept: can cause rejection/may be rejected</p> <p>Accept: need to use immunosuppressant drugs/(patient) more susceptible to infection as immunocompromised.</p> <p>Ignore: unethical if unqualified</p> <p>Accept: idea that embryo has right to life</p> <p>Accept: relies on couples having IVF (and not all do)</p> <p>Accept: relies on (informed) consent being given (from patient) for their use (and not all give this)</p> <p>Accept: relies on there being no law banning their use (and some countries have banned their use)</p>
03.4	<p>Unknown how similar iPSCs are to pluripotent/totipotent embryonic stem cells;</p>	1	<p>Accept: only pluripotent (and embryonic are totipotent)</p> <p>Accept: may not be able to form all/every type of cell/tissue</p> <p>Accept: still at research stage/more research needs to be done/not been tested on a large scale</p> <p>Accept: creation of iPSCs needs to be repeated (by other scientists)</p>

Question	Marking guidance	Mark	Comments
04.1	<p>SAN generates wave of electrical activity/impulses (across atria) causing atrial contraction;</p> <p>Non-conducting tissue (between atria and ventricles) prevents wave of electrical activity/impulses reaching ventricles immediately;</p> <p>Wave of electrical activity/impulses can only pass to ventricles via AVN (due to high electrical resistance of fibrous tissue);</p> <p>Delay (at AVN) ensures atria empty/ventricles fill (before ventricles contract);</p> <p>(AVN) sends wave of electrical activity/impulses down Bundle of His;</p> <p>Wave of electrical activity/impulses spreads out through Purkinje fibres/tissue to ventricular cardiac muscle,</p> <p>Ventricles contract from apex/base/bottom;</p>	5 max	<p>Accept: depolarisation/excitation for wave of electrical activity/impulses throughout</p> <p>Reject: 'signal(s)' for 'impulse(s)' throughout but penalise only once</p> <p>Accept: AVN imposes a delay on electrical activity/impulse passage <u>delaying</u> ventricular contraction</p> <p>Accept: ventricles contract upwards</p> <p>Accept: a correct description which omits reference to specialised terms for 3 marks.</p> <p>Accept: heart is myogenic for 1 mark if no other MPs awarded.</p> <p>Accept: reference to SAN, AVN, Purkinje fibres/tissue and Bundle of His for 1 mark if no other MPs awarded</p> <p>Accept: Purkyne for purkinje throughout.</p>

<p>04.2</p>	<p>Carbon dioxide/CO₂ concentration/level increases (in blood);</p> <p>(Detected by chemoreceptors) in aortic/carotid bodies/medulla;</p> <p>(Chemoreceptors send) impulses to medulla (oblongata)/cardiovascular centre (of medulla);</p> <p>Increased <u>frequency</u> of impulses (to/from medulla);</p> <p>Along sympathetic pathway/nervous system (to SAN);</p>	<p>5 max</p>	<p>Accept: pH falls/H⁺ increases/acidity increases</p> <p>Accept: references to high levels of carbon dioxide/ CO₂ (in the blood)</p> <p>Accept: (detected by) chemoreceptors in aorta/carotid arteries</p> <p>Reject: 'signals' for 'impulses' but penalise only once</p> <p>Accept: more impulses/increased rate of impulses</p>
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Question	Marking guidance	Mark	Comments
05.1	(So that) <u>Enzymes</u> are working at/near optimum/best temperature (for efficient reactions / metabolism); <u>Enzymes</u> prevented from being denatured;	1 max	Ignore: references to pH throughout Ignore: references to enzymes working effectively Accept: proteins not denatured
05.2	Temperature does not continue to rise/fall ; Temperature returns to 37 °C/set point/norm;	2	Accept: temperature does not rise/fall indefinitely Accept: idea that positive feedback involves a continued increase <u>and this doesn't</u>

<p>05.3</p>	<p>(increase in) sweating;</p> <p>(increase in) vasodilation;</p> <p>relaxation of hair muscles/hairs lie flat;</p> <p>reduced metabolism;</p>	<p>2 max</p>	<p>Accept: a correct description of vasodilation Reject: idea that blood vessels move closer to surface</p> <p>Accept: less respiration Reject: respiration stops Accept: less shivering Accept: shivering stops</p> <p>Ignore: references to behavioural responses such as taking clothes off</p>
<p>05.4</p>	<p>Idea that body temperature is a result/by-product of metabolic heat / metabolism/aerobic respiration;</p> <p>metabolic rate naturally fluctuates over a 24 hour/daily cycle;</p> <p>(metabolic) rate is highest in daytime during activity/lowest at night during sleep;</p>	<p>2 max</p>	<p>Accept: idea that metabolic rates are different at different times of the day</p> <p>Accept: idea that temperature is higher in the day time as an individual is more active (than at night) for 1 mark</p>

Question	Marking guidance	Mark	Comments
06.1	(Insulin sensitivity) values/means similar to those with diabetes; Reference to overlap of SDs (between diabetics and non-diabetics);	2	Accept: (insulin sensitivity) values/means not (significantly) different from those with diabetes Reject: reference to SE
06.2	Sensitivity (to insulin) does increase; (But) large SD/increase in SD/large variation/ (after GBS/surgery); SDs overlap <u>before and after GBS/surgery</u> ; (So) some (patients) showing no/little change; Do not know what sensitivity to insulin is of non-diabetics (who are not obese);	4	Ignore; reference to 'yes' or 'no' Accept use of figures/use of SD values to make this point Reject: SE if not seen in answer to Q06.1 Accept: SE if already penalised in answer to Q06.1 Accept: some (patients) get worse Accept: 'normal' = non-diabetic
06.3	Excess/high glucose/sugar in blood; Lowers water potential/ ψ (of blood); Diffusion/osmosis of water from/out of cells (into the blood); Reference to increase blood volume;	3 max	Reject: reference to in the body (as opposed to in the blood) Accept: converse direction

06.4	To allow comparison;	1	Ignore: references to large sample size Ignore: representative
06.5	0.69:1;; OR 1:1.44;;	2	Accept 1: 0.69 for 1 mark Accept: 27:39 for 1 mark Accept: 9:13 for 1 mark Reject: 39:27; 1.44:1; 13:9

Question	Marking guidance	Mark	Comments
07.1	Idea that different base sequences fit different shapes of <u>active sites</u> of enzymes.	1	
07.2	2,097,152 ;	2	Accept: 2^{21} for 2 marks Accept: 1,048,576 for 1 mark Accept: 2^{20} for 1 mark Accept: $2^{20} \times 2$ for 1 mark (if no answer seen or incorrect answer given) Reject: 4^{20}
07.3	(DNA) ligase;	1	
07.4	A. hybrid vector/plasmid OR recombinant vector/plasmid; B. original vector/(R)plasmid; C. (a circle/chain of human/foreign/donor DNA consisting of) <u>Three</u> DNA fragments/genes (that have joined together);	3	Accept: vector/plasmid with the (human/foreign) DNA fragment/gene (inserted) Accept: vector/plasmid containing recombinant DNA Accept: DNA fragment + plasmid Reject: DNA fragments + plasmids Accept: vector/plasmid without the human gene

07.5	<p>(Because) not all the (bacterial) cells took up the <u>R plasmid</u>;</p> <p>To select/identify the (bacterial) cells that had taken up the <u>R plasmid</u>;</p>	2	<p>Accept: only (bacterial) cells that had taken up the <u>R plasmid</u> grew on master plate/tetracycline</p> <p>Accept: <u>plasmid</u> for R plasmid throughout</p>
07.6	<p>C (no mark) because: C cannot grow in ampicillin (but can grow in tetracycline); (so) C has human DNA in ampicillin resistance gene (and has tetracycline resistance gene intact)</p>	2	<p>Accept: not resistant to ampicillin</p> <p>Ignore: references to (colony/bacteria) not being present on the replica plate</p>