OXFORD

INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL A-LEVEL

BIOLOGY (9610)

BL04

Unit 4 Control

Mark scheme

June 2022

Version: 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 Examiner.

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 oxfordaqaexams.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Marking guidance	Mark	Comments
01.1	1. Release of energy/ATP; 2. To combine acetate/acetyl and choline/make acetylcholine **OR** endocytosis/uptake of choline/acetate **OR** movement of Ca^{2+} ions out (of synaptic knob);	2	1. Reject make/produce energy 2. Accept supply acetyl CoA 2. Ignore CoA

Question	Marking guidance	Mark	Comments
01.2	1. Na^+ channels open/membrane permeability to Na^+ increased; 2. Na^+ entry by diffusion/down concentration gradient; 3. Depolarisation/inside more positive; 4. Threshold reached/action potential generated (in postsynaptic neurone);	4	1. and 2. Reject sodium once 4. Accept description of threshold/positive feedback

Question	Marking guidance	Mark	Comments
01.3	1. Closes Na^+ channels/prevents continuous production of A.P.; 2. Acetate and choline diffuse back into presynaptic neurone to resynthesize Ach;	2	1. Accept continuous firing/overstimulation/synaptic fatigue

Question	Marking guidance	Mark	Comments
01.4	1. Similar shape to acetylcholine/act as competitive inhibitor; 2. Block active site/prevent normal enzyme-substrate complexes; **OR** 3. Bind to enzyme/act as non-competitive inhibitor 4. Changes shape of active site/prevent normal enzyme-substrate complexes; 5. Acetylcholine remains in receptor causing continuous production of A.P./overstimulation; 6. Inhibits breathing/movement/feeding;	3 max	**Mark 1. and 2. together or 3. and 4. together** 1. Reject same shape 5. Accept runs out of acetate/choline **OR** Acetylcholine not regenerated

Question	Marking guidance	Mark	Comments
02.1	1. Fast have fewer blood capillaries; 2. Fast have fewer mitochondria; 3. Fast ATP production from anaerobic respiration, slow is aerobic; 4. Fast have more phosphocreatine/glycogen; 5. Fast have higher rate of ATP breakdown; 6. Fast fatigue more quickly/produce more lactic acid; 7. Fast have lower store of myoglobin	2 max	Must be comparative Accept converse 4. Accept PC for phosphocreatine

Question	Marking guidance	Mark	Comments
02.2	1. Hydrolysis of ATP / ATP $\rightarrow$ ADP + P_i to release energy; 2. Needed for movement of myosin heads;	2	 2. Accept release of myosin heads from binding sites 2. Accept for 'power stroke'/realignment

Question	Marking guidance	Mark	Comments
02.3	Correct answer for 2 marks = 26.15 – 27.69;; Accept for 1 mark, $\frac{\text{number of dark/17 or 18}}{\text{total/65}} \times 100$;	2	Accept correct rounding (26 – 28)

Question	Marking guidance	Mark	Comments
02.4	1. Marathon runners because highest %/85 % of slow fibres **which** have more mitochondria; 2. Higher % of aerobic respiration required/respiration is mostly aerobic;	1 1	

Question	Marking guidance	Mark	Comments
02.5	1. Increase in diameter of fibres due to training; 2. Slow fibres are thicker/wider (diameter); 3. Slow fibres have more capillaries;	2 max	

Question	Marking guidance	Mark	Comments
03.1	1. Pancreas detects high blood glucoses **and** secretes insulin; 2. Insulin binds to receptor on CSM/cell surface; 3. Causes vesicles with glucose transporter proteins/GLUT4 channel proteins to fuse with CSM; 4. Increases diffusion of glucose into cell; 5. Stimulates conversion of glucose to glycogen/glycogenesis; 6. Formation of glycogen maintains diffusion gradient for glucose into cell;	5 max	

Question	Marking guidance	Mark	Comments
03.2	1. Increase in high sugar diets; 2. Reduction in levels of exercise; 3. Increase in obesity levels **OR** Increase in blood cholesterol/blood lipids; 4. Increase in blood pressure;	3 max	Points should be in the context of populations not individuals. 2. Accept lack of exercise/less active 3. Accept 'overweight' for obesity

Question	Marking guidance	Mark	Comments
03.3	1. Increase in diabetes with age; 2. Greater incidence in males than females;	2 max	1. Accept positive correlation

Question	Marking guidance	Mark	Comments
03.4	1. (Differences) significant up to 49 **as** SE do not overlap; 2. (Differences) not significant above 50 **as** SE do overlap;	2	1. Accept (differences) due to chance for significant 2. Accept (differences) not due to chance for not significant 1. and 2. Reject 'results' once 1. and 2. Allow error bars 1. and 2. Reject SD once

Question	Marking guidance	Mark	Comments
04.1	1. Production of single stranded DNA/separate strands; 2. By breaking hydrogen bonds (between bases); 3. Annealing/attaching primers; 4. By binding of complementary bases (sequences); 5. Idea of synthesis of new DNA (strand/s); 6. By DNA polymerase;	6	1. Reject 'denature DNA' 4. Accept 'to prevent the (DNA) strands rejoining' 5. Reject synthesis of 'identical strand' 6. Accept 'Taq polymerase'

Question	Marking guidance	Mark	Comments
04.2	Correct answer for 2 marks = 4.10×10^3;; Accept for 1 mark, 4096 / 4100 / 4.09×10^3;	2	

Question	Marking guidance	Mark	Comments
04.3	1. Viral genetic material is RNA / influenza is a retrovirus; 2. (Reverse transcriptase) converts RNA into DNA;	2	1. and 2. Reject mRNA once 2. Accept cDNA

Question	Marking guidance	Mark	Comments
04.4	(Probe) has <u>base sequence</u> complementary to (base sequence of) viral DNA;	1	

Question	Marking guidance	Mark	Comments
04.5	The greater the amount of probe binding, the greater the amount of fluorescence **OR** The greater the fluorescence the more DNA produced;	1	Accept 'light intensity' for fluorescence

Question	Marking guidance	Mark	Comments
04.6	1. H1N1 has mutated **so** has different base sequence (to influenza A); 2. Less probe binds to H1N1 **so** less fluorescence;	2	 2. Accept lower/less RFU for fluorescence 2. Accept converse for influenza A

Question	Marking guidance	Mark	Comments
04.7	1. Track/predict progress of epidemic/pandemic; 2. Allow forward planning; **OR** 3. Develop (appropriate) vaccines; 4. Population has no immunity (to the new strain);	2 max	Mark in pairs 1 and 2 or 3 and 4 1. Reject 'prevent spread/progress' 4. Accept 'people' for population 4. Reject 'no resistance for immunity

Question	Marking guidance	Mark	Comments
05.1	1. Change in gene function/expression without changing the base sequence of DNA; 2. Heritable;	2	Accept idea that it can be passed down

Question	Marking guidance	Mark	Comments
05.2	1. Structure/shape of endoxifen similar to oestrogen; 2. Endoxifen binds to/blocks the oestrogen receptor in (tumour cells); 3. Less/no transcription of (target gene);	3	1. Reject same shape 1. Ignore complementary 1. Ignore 'competitive inhibitor' 2. Reject 'active site' 2. Allow 'transcription factor' for oestrogen receptor

Question	Marking guidance	Mark	Comments
05.3	1. RNA nucleotides bind to mRNA (template) by complementary base pairing/hydrogen bonds; 2. (RDRs) catalyse formation of (phosphodiester) bonds between adjacent nucleotides;	2	2. Reject any reference to hydrogen bonds

Question	Marking guidance	Mark	Comments
05.4	1. siRNA binds to a protein complex; 2. ATP used to separate double-stranded RNA into single strands; 3. Single strands bind to (target) mRNA (in protein complex) by complementary base pairing/hydrogen bonds; 4. mRNA broken down/cut into fragments; 5. mRNA can no longer be read/translated **OR** The protein can no longer be made; 6. The greater the amount of mRNA in a cell, the greater the amount of siRNA produced (self-regulation);	4 max	

Question	Marking guidance	Mark	Comments
06.1	Correct answer for 2 marks = 200 - 217;; Accept for 1 mark, 216.666 **OR** correct method shown $\frac{(285 - 90)}{90} \times 100$ **OR** $\frac{285}{90} \times 100) - 100$	2	

Question	Marking guidance	Mark	Comments
06.2	Correct answer for 2 marks = 8;; Accept for 1 mark, 8.235/8.24/82 **OR** $\frac{\text{measurement in mm}}{\text{magnification}} \times 1000$ **OR** $\frac{7 \times 1000}{850}$	2	

Question	Marking guidance	Mark	Comments
06.3	1. Inflow of calcium ions **causes** outflow of potassium ions; 2. Water potential (ψ) of guard cells increased/less negative; 3. Water leaves guard cells by osmosis/diffusion from high ψ to low ψ/down a ψ gradient; 4. Loss of turgidity in guard cells **causes** stomatal closure;	4	1. Accept inflow of calcium ions cause outflow of chloride ions opening **outward** potassium channels 2. Accept more positive ψ 2. Accept ψ of cells around guard cells decreased/more negative 4. Accept guard cells become flaccid 4. Reject turgid/flaccid stomata

Question	Marking guidance	Mark	Comments
06.4	1. Stomatal apertures greater/wider in plants with mutation; **OR** ABA less effective in reducing stomatal aperture in plants with mutation (at both concentrations of ABA); 2. Greater difference at higher concentrations of ABA; 3. Effect is significant **as** standard error bars do not overlap;	3	1. and 2. Accept converse 1. Ignore references to stomatal apertures increasing with increasing concentration of ABA 2. Accept greatest difference at 10µmol dm^{-3} /highest ABA concentration 3. Allow error bars/SE. Reject SD 3. Accept effect is not due to chance

Question	Marking guidance	Mark	Comments
06.5	1. Use of eyepiece graticule **and** microscope to measure stomatal aperture; 2. Measure stomatal aperture (of both plant types) with no ABA; 3. Different concentrations of ABA injected/inserted into guard cells; 4. Measure stomatal aperture (of both plant types) after injecting ABA **OR** Measure stomatal aperture (of both plant types) at different ABA concentrations; 5. Repeats and calculation of means and standard errors;	4 max	If no marks awarded allow for one mark Mention of control variables between WT and mutated plants during the investigation 5. Ignore reference to S.D. 5. Allow error bars