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INTERNATIONAL A-LEVEL

BIOLOGY

BL04 (9610)

Unit 4 Control

Mark scheme

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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. Totipotent cells can differentiate into any type of cell **and** unipotent cells cannot / can only differentiate into one type; 2. Totipotent cells occur **only** for a limited time Or Totipotent cells found **only** in an embryo (and unipotent are found in mature mammals);	2	For differentiate allow descriptions e.g. develop, specialise

Question	Marking guidance	Mark	Comments
01.2	1. (iPS cells) divide **and** develop to become cone cells Or (iPS cells) differentiate/specialise to become cone cells; 2. All the DNA in present in these cells Or Genes are switched (back) on;	2	

Question	Marking guidance	Mark	Comments
01.3	1. iPS cells will have the same DNA as the patient Or iPS cells will have same antigens as the patient / have self-antigens (on their surface); 2. (So) reduces the risk of rejecting implanted cells / immune response;	2	1. Allow alleles/genes for DNA If neither point awarded – allow other ideas e.g. no use of embryos so less ethical issues or idea of unlimited supply

	Marking guidance	Mark	Comments
01.4	1. Each (ganglion cell/bipolar) neurone to the brain is connected to very few cone cells / to a single cone cell Or Each (ganglion cell/bipolar) neurone to the brain is connected to several rod cells; 2. (So) no retinal convergence / impulses from each cone kept separate;	2	2. Allow converse for rod cells 2. Accept idea that each cone only represents a small area of the retina

Question	Marking guidance	Mark	Comments
02.1	0.0065 / 6.5 x 10^{-3} (pH units min^{-1})	2	Allow one mark for answer correctly derived from incorrect graph reading(s)

Question	Marking guidance	Mark	Comments
02.2	1. (High intensity exercise causes) higher rate of respiration (in muscle cells); 2. Greater increase in carbon dioxide produced (causes greater decrease in blood plasma pH)	2	2. Allow credit for increase in lactate production.

Question	Marking guidance	Mark	Comments
02.3	1. Chemoreceptors (in aortic / carotid bodies) detect increased carbon dioxide concentration / decreased pH; 2. Send impulses to cardiac centre / cardioaccelerator centre / medulla; 3. Increased frequency of impulses to sinoatrial node / SAN; 4. Along sympathetic pathway;	3 max	

Question	Marking guidance	Mark	Comments
03.1	1. Restriction enzyme / endonuclease; 2. Cuts DNA at specific/recognition sites / after specific base sequence; Or 3. Reverse transcriptase; 4. To produce cDNA copy (of PL1) from (isolated) bacterial mRNA;	2	Mark in pairs

Question	Marking guidance	Mark	Comments
03.2	Polymerase chain reaction / PCR;	1	

Question	Marking guidance	Mark	Comments
03.3	1. (If injected into isolated plant cells) all cells (in the new plant/clone) will have the PL1 gene / produce PL1 (protein) Or (If injected in mature plant) only a small number of cells in the plant would have PL1 gene / express the gene; 2. Can produce a large number of (cloned plants) producing PL1 / largescale production of plants producing PL1;	2	

Question	Marking guidance	Mark	Comments
03.4	Any **four** from the following: **Pros** 1. (3-days after infection) there is less bacterial DNA in the transformed plants than in the control plants Or (3-days after infection) there is a decrease in the ratio of bacterial DNA to crop plant DNA; **Cons** 2. Only a single type of crop plant investigated / other species might not show the same response; 3. Only one type of bacterial plant pathogen investigated / PL1 might not have the same effect on other bacterial pathogens; 4. Measuring bacterial DNA would include both living and dead bacteria **so** results differences between the two groups may be greater (after 3-days); 5. No statistical test carried out / sample size unknown; 6. Short duration of the investigation / only measured the results after 3-days / long-term effects unknown; 7. Bacterial DNA has increased in transformed plants after 3-days so they may show symptoms caused by the pathogen; 8. Only measured bacterial DNA from infected leaves so results may be different in other parts of the plant; 9. Only a small reduction in the ratio of bacterial DNA to crop plant DNA;	4 max	At least one mark from each to gain maximum marks 3. Allow only one type of disease 5. Allow only one investigation/trial 6. Allow reference to no error bars so cannot tell if difference is likely to be significant

Question	Marking guidance	Mark	Comments
04.1	1. Other medications may inhibit / interact with dobutamine; 2. (Scientists would be) unable to determine the actual effect of dobutamine (on cAMP production);	2	1. Allow idea of altering the action of dobutamine / hormones e.g. adrenaline (on liver cells) 2. Accept: the results would not be valid

Question	Marking guidance	Mark	Comments
04.2	1. Adrenaline binds to (specific/protein) receptors (on the surface of cells) **and** activates the enzyme adenyl cyclase (inside the cell); 2. (Activated adenyl cyclase) converts ATP to cAMP; 3. cAMP activates other enzymes / protein kinase; 4. (Activated) enzymes / protein kinase causes conversion of glycogen to glucose;	4	4. Accept glycogenolysis / glucogenesis 4. Allow breakdown / hydrolysis for conversion

Question	Marking guidance	Mark	Comments
04.3	At adrenaline concentration 10^{-8} 1. Dobutamine has no (significant) effect on cAMP production Or cAMP production remains relatively constant; 2. (cAMP production remains) around 5 (arbitrary units); At adrenaline concentration 10^{-6} 3. Dobutamine concentrations 10^{-8} to 10^{-6} have no (significant) effect on cAMP production / production of cAMP remains constant; 4. (But) dobutamine concentrations of 10^{-5} and 10^{-4} cause a (significant) decrease in cAMP production;	3 max	3. Allow up to concentration 10^{-6} 4. Allow above concentrations 10^{-6}

Question	Marking guidance	Mark	Comments
04.4	1. Both compete / can bind/fit to the same (protein) receptors on the surface of cells; 2. (At higher dobutamine concentrations) less adrenaline can bind to receptors (so effect of adrenaline on cAMP production inhibited) Or (At higher dobutamine concentrations) more dobutamine attaches to receptors (producing a weaker effect on cAMP production);	2	

Question	Marking guidance	Mark	Comments
05.1	1. Sodium-potassium pumps actively transport sodium ions out of axon (in exchange for potassium ions into the axon); 2. (Voltage-gated sodium ion channels are closed so) sodium ions cannot diffuse back into axon but some potassium ions can diffuse out;	2	2. Allow the membrane is more permeable to potassium ions (than sodium ions) so potassium ions diffuse out

Question	Marking guidance	Mark	Comments
05.2	(Neurone in solution **Y** had a) slower depolarisation/rise in membrane potential **and** peaked at a lower membrane potential;	1	Answer must be comparative Accept converse for solution **X**

Question	Marking guidance	Mark	Comments
05.3	1. Slower rise in membrane potential **due** to smaller concentration gradient for sodium ions (entering the axon from solution **Y**); 2. Lower peak in membrane potential **due** to less sodium ions entering the axon (from solution **Y**);	2	Answer must be comparative for both marking points.

Question	Marking guidance	Mark	Comments
05.4	**Experiment 1** 1. (Two) impulses in quick succession from same neurone / neurone **A** **so** (temporal) summation; **Experiment 2** 2. (Impulses from neurones **A** and **B** at the same time) so (spatial) summation; **General points** (only award once) 3. Release enough neurotransmitter; 4. (So enough sodium ions enter neurone **D**) to reach threshold value; 5. To cause depolarisation / produce an action potential/impulse in neurone **D**;	5	1. Need idea of second impulse arriving before return to resting potential i.e. impulses in quick succession 1. & 2. Allow idea of additive effects impulses 3. Allow a single impulse from (either) neurone **A** (and **B**) causes insufficient release of neurotransmitter

Question	Marking guidance	Mark	Comments
05.5	1. Inhibitory (synapse between **C** and **D**); 2. (Neurotransmitter from **C** causes) membrane of **D** to become hyperpolarised / (membrane potential of) **D** to become more negative (than resting potential); 3. (Membrane potential of) **D** further from threshold value **so** action potential is less likely to occur Or To produce an action potential in **D** even more sodium ions need to diffuse in (to reach threshold value)	3	

Question	Marking guidance	Mark	Comments
06.1	1. To sterilise the seeds / kill bacteria/fungi/microorganisms (on the seeds); 2. To prevent the seeds/agar from drying out /desiccating;	2	

Question	Marking guidance	Mark	Comments
06.2	**Two** suitable suggestions e.g. 1. Distance between the seeds in each plate; 2. Composition of the agar / amount of water added to agar in both plates; 3. Temperature (in both the light and dark rooms); 4. Same method for measuring angle of growth;	2	Allow other suitable suggestions e.g. age of seeds, pH of the growth medium Ignore reference to oxygen/carbon dioxide concentration

Question	Marking guidance	Mark	Comments
06.3	The mean root tip angle increased (to around 90^{o}) at a faster rate / reached around 90^{o} before the roots of the seedlings in the dark room;	1	

Question	Marking guidance	Mark	Comments
06.4	Differences in results may be due to chance / only one experiment / experiment does not prove a causal link between light and geotropism / small sample size;	1	

Question	Marking guidance	Mark	Comments
06.5	Standard error and 95% confidence limits / (student) t-test	1	

Question	Marking guidance	Mark	Comments
06.6	1. (For 2 and 4 hours) there is a significant difference (between the mean level of protein marker between the left and right side); 2. The probability of this difference being due to chance is less than 0.01 / 1% or less than 0.05 / 5%; **OR** 3. (For 0 and 0.5 hours) there is no significant difference (between the mean level of protein marker between the left and right side); 4. The probabily of this difference being due to chance is more than 0.01 / 1% or more than 0.05 / 5%;	2 max	Mark in pairs

Question	Marking guidance	Mark	Comments
06.7	1. More carriers on the left side / less on the right-side; 2. (So) less auxin on the left side / more auxin on the right-side; Or (So) more auxin moves out of the left side / less auxin moves out on the right-side; 3. More growth on the left-side / less growth on the right-side; Or Less inhibition of growth on the left-side / more inhibition of growth on the right-side;	3	3. For growth allow elongation

Question	Marking guidance	Mark	Comments
07.1	Correct answer in range of 88 – 89 (µm);;;	3	For two marks: • correct calculation but answer given in mm • correct answer but in the incorrect order of magnitude For one mark: Radius = 0.6182/0.62 (mm) or diameter 1.24 (mm)

Question	Marking guidance	Mark	Comments
07.2	1. Measure (diameter) of muscle fibres using an eyepiece graticule; 2. Calibrate eyepiece graticule against stage micrometer / object of known length;	2	

Question	Marking guidance	Mark	Comments
07.3	Fast fibres have more ATPase and so stain dark;	1	

Question	Marking guidance	Mark	Comments
07.4	Any **three** from the following: 1. In the 16-month- and 28-month-old rats, fenoterol caused a (significantly) higher peak/ATPase activity (compared to the control rats in both slow and fast fibres); 2. Fenoterol caused a higher increase in ATPase activity in the 16-month-old rats (for both slow and fast fibres) compared to the 28-month-old rats; 3. Fenoterol causes a greater increase in ATPase activity of the fast fibres than the slow fibres; 4. There was a significant difference in the peak ATPase activity of slow fibres between the 16-month and the 28-month fenoterol groups Or There was no significant difference (in the peak) ATPase activity of fast fibres between the 16-month and the 28-month fenoterol groups;	3 max	

Question	Marking guidance	Mark	Comments
07.5	1. Contraction of fast fibres produces a greater force; 2. Fast fibres reach peak in force of contraction at a faster rate;	2	

Question	Marking guidance	Mark	Comments
07.6	Higher concentration of calcium ions so 1. (Calcium ions bind to tropomyosin so) higher rate of tropomyosin movement / binding sites on actin become available faster / formation of actinomyosin bridges occurs faster; 2. (Calcium ions cause higher rate of ATPase activity so) faster/more release of energy for myosin-actin interaction / myosin head movement;	2	Must include idea of faster / greater at least once

Question	Marking guidance	Mark	Comments
07.7	1. Fenoterol increased the force of contraction (of both fast and slow fibres); 2. Fenoterol caused a larger increase in the force of contraction of fast fibres / caused the contraction force of the fast fibres to increase by 200 (mN) **and** the slow fibres by 90 (mN) (compared to the control); Or Fenoterol caused a higher percentage increase in the force of contraction of slow fibres (compares to the control) / caused a 30% increase in the contraction force of slow fibres **and** a 17.9% increase in the contraction force of the fast fibres (compared to the control);	2	2. Don't accept answers just quoting data