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BIOLOGY (9610)
BL04

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 oxfordaqa.com

Question	Marking guidance	Mark	Comments
01.1	(Totipotent cells that can) differentiate into any type of cell, (including a new organism); (Pluripotent cells that can) differentiate into most types of cell, (but not a new organism);	2	1 & 2. For differentiate accept produce/develop/specialise/divide 2. Allow many types

Question	Marking guidance	Mark	Comments
01.2	1. Heart damage (following heart attack); 2. Diabetes;	2	Allow any valid disorder eg muscular dystrophy, Parkinson's, MS, stroke, Alzheimer's, spinal/nerve damage/paralysis, leukaemia, burns, osteoporosis, osteoarthritis, macular degeneration, any named recessive inherited disorder

Question	Marking guidance	Mark	Comments
01.3	1. No embryos are destroyed **OR** embryos cannot give consent; 2. No/less risk of rejection/immune response (as cells derived from the patient); 3. Easier to get/unlimited supply;	2 max	Ignore ethical/moral/religious issues unless qualified Ignore reference to cost Ignore 'easier' unqualified 2. Allow no need for immunosuppressants

Question	Marking guidance	Mark	Comments
01.4	1. Drug testing/trials; 2. Disease modelling/personalised medicine; 3. (To investigate) organ function;	2 max	1. Allow testing of vaccines 2. Ignore treatment of cancer but allow cancer research Ignore reference to organ transplants Ignore reference to medical research

Question	Marking guidance	Mark	Comments
02.1	1. Each restriction enzyme (cuts DNA) at a specific base sequence; 2. These specific base sequences are found at different distances (from the gene);	2	1. Allow restriction sites/recognition sequence for 'specific base sequence'

Question	Marking guidance	Mark	Comments
02.2	1. Recombination efficiency increases up to 1kb; 2. Then levels off;	2	

Question	Marking guidance	Mark	Comments
02.3	No overlap of error bars up to 1kb **so** difference is significant; **OR** Overlap of error bars between 1 – 4kb **so** difference is not significant;	1	Allow points between recombination efficiency instead of flanking region size Ignore results/data are significant/not significant For significant / not significant, allow reference to chance eg for significant allow difference is not due to chance

Question	Marking guidance	Mark	Comments
03.1	1. (ATPase) line to myosin; 2. (Tropomyosin) line to actin;	2	

Question	Marking guidance	Mark	Comments
03.2	Answer in range 21.5 – 26.0 (mm);;;	3	**Two marks** for: Number of sarcomeres 10,000 – 12,069 Difference in sarcomere length = 1.05 μm Correct figures for contracted fibre length but incorrect order of magnitude Answer correctly derived from an incorrect measurement **One mark** for relaxed sarcomere length = 2.9 – 3.5 μm

Question	Marking guidance	Mark	Comments
03.3	1. Myosin now present (between the actin filaments); 2. Actin filaments are moved over/along/between the myosin filaments (when contracting);	2	

Question	Marking guidance	Mark	Comments
03.4	1. (ATPase) hydrolyses ATP to release energy; 2. Energy/ATP used to form actinomyosin bridges; 3. Tropomyosin blocks the binding sites on actin in **B**; OR Tropomyosin not blocking the binding sites on actin in **C**; 4. Calcium ions (bind to and) cause tropomyosin to move; 5. (**B**) less/no actinomyosin bridges form **so** low(est) ATPase activity; OR (**C**) actinomyosin bridges form **so** high(est) ATPase activity; 6. Calcium ions activate/increase activity of ATPase;	6	1. Allow breakdown for hydrolyses 1. Do not allow energy is produced 2. Accept other uses of energy/ATP in contraction eg pivoting of myosin heads 3. Do not allow if reference to active site on actin 4 & 6. Allow Ca^{2+} for calcium ions 5. For actinomyosin bridges allow myosin head attaches to (binding sites) on actin

Question	Marking guidance	Mark	Comments
04.1	1. Less sodium ion channels have opened in **F** **OR** Fewer sodium ions have entered (the axon) in **F**; 2. (Idea of) threshold value not met;	2	Accept converse 1. Do not allow no sodium ion channels have opened

Question	Marking guidance	Mark	Comments
04.2	1. (Myelinated neurone) depolarisation/ion movement can only occur at the nodes **OR** (Myelinated neurone) myelin insulates (the axon)/prevents ion movement (except for at the nodes); 2. (Myelinated neurone) saltatory conduction can occur **OR** (Non-myelinated) each section of the neurone must depolarise/(wave of) depolarisation has to pass along the whole length of the neurone;	2	1. Allow action potential for depolarisation 2. Accept descriptions for saltatory conduction eg impulse can jump from node to node

Question	Marking guidance	Mark	Comments
04.3	0.1/0.10/0.103 (μm);;;	3	**One mark** for diameter (D) **J** = 0.65 **and K** = 0.85 OR For evidence of dividing by 2 (for myelin thickness) **Two marks** for 0.2/0.21 or 0.25 and 0.45

Question	Marking guidance	Mark	Comments
04.4	1. (For each range of axon diameter) mutation causes a (slightly) higher g-ratio; 2. Mutation causes a decrease in myelin thickness; 3. (**Figure 8** shows that) as myelin thickness decreases so does the speed of conductance;	3	

Question	Marking guidance	Mark	Comments
05.1	Mechanisms which restore systems to their original/set/optimum level;	1	

Question	Marking guidance	Mark	Comments
05.2	1. (Idea that it would) lead to further deviation from the set level/norm; 2. (So) internal environment is not maintained within set limits;	2	2. Allow the idea that it could lead to a harmful effect on the body.

Question	Marking guidance	Mark	Comments
05.3	1. Adrenaline binds to complementary receptor (on CSM); 2. Binding causes G protein/protein on the membrane to change shape; 3. (Change in shape) activates <u>adenyl cyclase</u> (which converts ATP to cAMP); 4. cAMP activates a <u>protein kinase/PKA</u> enzyme (which converts glycogen to glucose); 5. Activated enzyme Y phosphorylates enzymes/causes phosphorylase to break down glycogen to glucose; 6. <u>Hydrolysis</u> of glycogen to glucose; 7. Glucose leaves (the cell) through glucose transport proteins OR Glucose leaves (the cell) by facilitated diffusion;	5 max	1. Allow a description of complementary 6. Allow glycogenolysis

Question	Marking guidance	Mark	Comments
05.4	1. cAMP is made from ATP; 2. Mitochondria produce ATP;	2	1. Allow ATP is converted to cAMP

Question	Marking guidance	Mark	Comments
05.5	1. Oestrogen is lipid soluble / non-polar / hydrophobic; 2. Able to pass through the CSM;	2	

Question	Marking guidance	Mark	Comments
06.1	1. Genetic code is universal; 2. Bacteria have the same protein synthesising mechanisms/have ribosomes;	2	1. Allow descriptions of universal

Question	Marking guidance	Mark	Comments
06.2	1. Stage 2: cDNA made (using mRNA as a template); 2. Enzyme: Reverse transcriptase; 3. Stage 3: Double stranded DNA made; 4. Enzyme: DNA polymerase;	4	

Question	Marking guidance	Mark	Comments
06.3	1. (Restriction enzyme cuts DNA) at a specific base sequence; 2. Leaving complementary sticky ends;	2	1. Allow restriction site/recognition sequence for 'specific base sequence'

Question	Marking guidance	Mark	Comments
06.4	2, 4, 5, 8, 9; 6, 7, 10;	2	

Question	Marking guidance	Mark	Comments
06.5	Time consuming / involves replica plating / errors in replica plating / introduces antibiotic resistance to bacteria;	1	Allow colonies containing the human gene are killed (by tetracycline)

Question	Marking guidance	Mark	Comments
06.6	Fluorescent/enzyme (gene marker);	1	Ignore references to radioactive markers Allow GFP / herbicide resistance gene

Question	Marking guidance	Mark	Comments
07.1	1. Action potential causes (calcium ion channels to open and) calcium ions to enter (the presynaptic knob); 2. (Calcium ions cause the) vesicles to fuse with the (presynaptic) membrane and release serotonin/neurotransmitter;	2	1. Allow Ca^{2+} for calcium ions 2. Allow serotonin released through exocytosis

Question	Marking guidance	Mark	Comments
07.2	1. Prevents neurotransmitter/serotonin from (continued) binding to receptors; 2. Prevents continued stimulation/action potentials/depolarisation (in the post-synaptic neurone);	2	1 & 2. Allow converse answers based on what would happen if it were not reabsorbed 2. Accept prevents sodium ion channels from staying open If no other mark awarded allow (for one mark) idea that serotonin can be packaged back into vesicles before further stimulation of the presynaptic neurone

Question	Marking guidance	Mark	Comments
07.3	1. Shows the effect of saline (on its own does not affect serotonin levels) **OR** To provide a baseline level (of serotonin without MDMA) **OR** To act a control group to make comparisons against; 2. To show that any changes in the results (of the rats in groups R–T) are due to MDMA;	2	1. Group Q as a control group - needs further qualification

Question	Marking guidance	Mark	Comments
07.4	1. (All concentrations of) MDMA caused a significant <u>increase</u> in serotonin concentration (when compared to the control group); 2. No significant difference/increase in the serotonin concentration between groups R – T;	2	1. Instead of significant increase allow <u>increase</u> is not due to chance 2. Instead of no significant difference allow difference could be due to chance

Question	Marking guidance	Mark	Comments
07.5	1. MDMA blocks (the attachment of serotonin to) the SERT (carrier proteins); 2. Less/no serotonin reabsorbed (back into presynaptic knob) **so** concentration (in the synaptic cleft) increases; **OR** 3. MDMA blocks the (attachment of serotonin to) receptors (on the post-synaptic membrane); 4. Less/no serotonin attached to receptors **so** concentration of serotonin (in the synaptic cleft) increases;	2 max	Mark in pairs 2. For 'less/no' allow reabsorbed more slowly 1 & 3. Instead of attachment - allow idea that MDMA causes damage e.g. to SERT carrier proteins / receptors

Question	Marking guidance	Mark	Comments
07.6	**Support**: 1. MDMA causes a (significant) decrease in the number of intact neurones (as SD does not overlap between groups); 2. As the serotonin concentration increases, the number of intact neurones decreases; 3. Correlation coefficient is –0.907 **so** strong negative correlation; 4. Correlation (between the number of intact neurones and serotonin concentration) is significant as P<0.001/0.05; **Against**: 5. Only used rats **so** different effects could be seen in other species/organisms; 6. Only used adult/male rats **so** different effects could be seen rats of different ages / female rats; 7. Only used 24 rats/small sample size **so** not representative; 8. Only investigated for 7 days **so** long-term effects not known; 9. Only one investigation **so** not shown to be repeatable; 10. Investigation shows a correlation but does not provide evidence that (high concentration of) serotonin causes damage to neurones;	5 max	For full marks must have points in support **and** against 2. Ignore negative correlation unqualified 4. Allow less than 0.1% or less than 5%