AQA

A-LEVEL
Biology

BIOL5 – Control in cells and in organisms
Mark scheme

2410
June 2016

Version: 1.0 Final

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Question	Marking Guidance	Mark	Comments
1(a)(i)	C;	1	
1(a)(ii)	D;	1	
1(b)	(Synaptic) vesicles (only) found in presynaptic (part of synapse);	1	Accept bulb of synapse for presynaptic. Reject vesicles **in** the membrane
1(c)(i)	Has similar shape/structure to dopamine **OR** Complementary (to binding site on receptor);	1	Ignore competitive inhibitor Accept tertiary structure Reject active site Reject **same** shape as dopamine/as receptor
1(c)(ii)	1. (Binding) does not lead to opening of sodium ion channels; 2. (So) no depolarisation / threshold not reached / sodium ions do not diffuse in; **OR** 3. Opens chloride ion channels; 4. Causing hyperpolarisation / preventing depolarisation	2	Mark either 1 and 2 **OR** 3 and 4 1. Accept stops dopamine opening sodium ion channels 1. Reject sodium unqualified 2. Accept no generator potential 3. Reject chlorine

Question	Marking Guidance	Mark	Comments
2(a)	1. (Maintain) optimum temperature for enzymes; 2. If temperature rises (above normal/optimum), enzyme activity falls; 3. If temperature falls (below normal), then low kinetic energy/fewer enzyme-substrate collisions; 4. Maintains (high) rate of (biochemical) reactions/metabolic rate/respiration;	3 max	2. Accept protein(s) denature 2 Accept denature 2 Accept high temperature 4 Requires idea of maintaining/keeping constant 4 Accept named process that is maintained at high rate 4 Requires idea of homeostasis, i.e. keeping a constant state
2(b)	1. Cooling causes more (electrical) activity (in neurones controlling BAT); 2. (More) heat from aerobic respiration (in BAT); 3. (Higher respiration) shown by increase in carbon dioxide production; 4. Heat from electron transfer chain / no (oxidative) phosphorylation; 5. Heat taken by blood to rest of body (raising core temperature);	4 max	Ignore any parts of answer that refer to warming of skin

Question	Marking Guidance	Mark	Comments
3(a)	9 (hours);; If multiply 75 by 0.11 and 0.23 but wrong answer, then 1 mark	2	Accept for **one** mark if multiply 75 by two wrong proportions near to 0.11 ± 0.01 and 0.23 ± 0.01 or multiply by the difference between the two (wrong) proportions
3(b)	(Yes because) 1. Both/Each species (mean) time spent looking around greater where many predators; 2. Differences (appear to be) significant because SDs do not overlap; (No because) 3. Wildebeest spend same (mean) time looking around where many predators as impalas where few predators; 4. Don't know what they are looking for (when heads up); 5. Habitats might be different in different areas (which could affect the behaviour);	4max	Accept 'mean proportion' means 'time' 1. Require idea of both, not just quoting numbers 2. This point must be in the context of point 1 2. Do not accept results significant 2. Accept 'because bars do not overlap' 2. Do not accept SE for SD 3 Accept overlap in SD as equivalent to same time 5. Ignore 'other factors' unqualified and discussions of experimental variables
3(c)	1. Less time spent feeding **OR** More energy lifting head/looking round; 2. (So) less food/biomass for respiration **OR** less energy for growth/reproduction/care of young; **OR** 3. Raising head makes them more visible to predators; 4. So more likely to be attacked/eaten/killed;	2	2. Accept any appropriate suggestion of less energy for something to do with life of the herbivore 2 Allow less food/biomass for growth/reproduction 2 Ignore references to energy for respiration

Question	Marking Guidance	Mark	Comments
4(a)	1. (Reaction with ATP) breaks/allows binding of myosin to actin/ actinomyosin bridge; 2. Provides energy to move myosin head;	2	1. Credit 'breaks' or 'allows' binding to actin (because cyclical) 2 Allow in context of 'power stroke' or 're-cocking' (because cyclical) 2. Ignore contraction on its own
4(b)(i)	Any value between 68.5 and 69.49 (%);; If get difference of 0.9 but calculation of percentage incorrect, then award 1 mark;	2	
4(b)(ii)	(Mutant mice) 1. Unable to make phosphocreatine/ less phosphate available to make/recycle ATP; 2. So less energy/so less ATP available for contraction/fast muscle fibres;	2	1 and 2. Reject production/creation of energy once 2. Accept less energy for grip 2. Accept no energy/no ATP for contraction/fast muscle fibres
4(c)	1. (Heterozygous) have one dominant/normal allele (for creatine production); 2. (This) leads to production of enough/normal amount of creatine;	2	1. Accept has one allele/one copy of the gene for/that is making creatine

Question	Marking Guidance	Mark	Comments
5(a)(i)	Restriction endonuclease;	1	
5(a)(ii)	(DNA) ligase;	1	
5(b)	(For those plants that contained the desired gene in the nucleus/plant DNA) 1. (DNA of desired gene) copied/replicated with host DNA/inside nucleus; 2. Passed on by mitosis/plant grows by mitosis; 3. Produces genetically identical cells/clones;	3	Ignore references to protein synthesis or plasmids not taking up the gene 1. Accept DNA replication during mitosis 1. and 2. Accept converse for plants with the gene in the cytoplasm 3. Neutral 'identical unqualified' 3. Accept description, e.g., DNA is the same
5(c)	1. Genetic code is universal/triplets in DNA always code for same amino acid; 2. It/insect DNA can be transcribed; 3. Can be translated (process/mechanism same in all organisms/cells);	3	2. Accept (basic) transcription (process/mechanism) same in all organisms/cells; 2. Accept descriptions of process 3. Accept descriptions of process

Question	Marking Guidance	Mark	Comments
6(a)	1. Treat with insulin (injection/infusion); 2. (Control) diet/control sugar intake;	2	2. Accept '(regular) exercise'
6(b)	1. Damage to <u>autonomic</u> (nervous) system in diabetic rats; 2. (Could be) pressure receptors/baroreceptors (in arteries/aorta/carotid body) don't work as well; 3. Damage to medulla **OR** Change in (number of) impulses to/from medulla; 4. (When pressure drops damage to) sympathetic system, so doesn't speed up (enough); 5. (When pressure rises damage to) parasympathetic system, so doesn't slow down (enough);	4 max	Accept answers in terms of what happens in healthy rats **only** if then qualified by statement these things don't happen/happen less in rats with diabetes. 1. Accept damage to ANS 2. Ignore reference to chemoreceptors 4 and 5 appropriate system and effect on heart rate both needed

Question	Marking Guidance	Mark	Comments
7(a)	1. Binding (of interferon gamma) changes shape/tertiary structure of receptor (protein); 2. This activates/switches on the enzyme; 3. Use of ATP (to phosphorylate STAT1);	2 max	1. Accept reference to second messenger mechanism/process 3. Context is important
7(b)	1. Phosphorylated STAT1; 2. IRF (protein);	2	Accept in either order 1. Must be phosphorylated but accept STAT1P 2. Ignore references to phosphorylated
7(c)	1. Causes more helper T cells to form; 2. (So) more interferon (gamma) production (by helper T cells);	2	1. and 2. require idea of more
7(d)	1. (Tumour suppressor gene) slows cell division/causes death of damaged/tumour/cancer cells; 2. *IRF* gene leads to formation of IRF (protein) that binds to gene B; 3. (Gene B protein) causes death of damaged/mutated cells OR slows division;	3	2. 'It' means *IRF* gene 3. Context is important 3. If clearly stated **and** includes the protein, scores 2 marks because it subsumes point 1

Question	Marking Guidance	Mark	Comments
8(a)(i)	Does not code for amino acid/tRNA/rRNA;	1	Accept 'does not code for production of protein/polypeptide' Reject 'that produces/makes amino acid'
8(a)(ii)	Deletion mutation;	1	Accept 'deletion' Ignore references to splicing
8(b)	(The) polymerase chain reaction;	1	Accept PCR
8(c)	1. Probes are single stranded / have a specific base sequence; 2. Complementary base sequence on (specific) spacer **OR** 3. Complementary/specific to (particular) spacer; 4. (In white squares probe) binds (to single-stranded spacer) and glows/produces light/fluoresce;	3	2. Need idea of complementary to spacer 3. Accept converse for dark squares

8(d)	1. To see if strain is resistant to any antibiotics; 2. So can prescribe effective/right antibiotic; **OR** 3. To see whether (any) vaccine works against this strain/ see which vaccine to use/ to produce specific vaccine; 4. (So) can vaccinate potential contacts/to stop spread; **OR** 5. Can test other people to see if they have the same strain/ to trace where people caught TB; 6. Allowing control of spread of disease/vaccinate/treat contacts (of people with same strain) before they get TB;	2 max	Do not allow mix and match of points from different alternative pairs

Question	Marking Guidance	Mark	Comments
9(a)	1. Antigen stimulates immune response / activates B/T cells; 2. B/T cells divide OR antibodies produced; 3. Antibodies/T cells attack myelin sheaths;	3	Ignore references to antigen binding to myelin
9(b)	1. Fewer cristae/smaller surface area (of cristae); 2. So less electron transport/oxidative phosphorylation; 3. (So) not enough ATP produced **OR** Not enough energy to keep neurones alive;	3	1. Accept 'inner membrane' as 'cristae' 2. Accept fewer ATP synthase enzymes 2. Accept lower rate of electron transfer/oxidative phosphorylation 3. Accept less use/stimulation of neurone leads to death of cell 3. Accept no/less ATP produced/no energy to keep neurones alive 3. Ignore references to glycolysis/ Krebs cycle
9(c)(i)	(Transmission) electron (microscope) – **no mark** Need high resolution (to see structure of mitochondria)	1	Accept 'scanning electron microscope' /TEM/SEM Accept – optical microscope not high enough resolution
9(c)(ii)	1. Took photographs/areas at random; 2. Counted total number (of normal) and number of unusual mitochondria; 3. Divided number of unusual mitochondria by total number and multiply by 100;	3	1. Accept (very) large number of areas/photos/samples MP 3 = 2 marks (includes MP2)
9(d)(i)	1. To see if the groups were similar; 2. So these factors can be taken into account/ to look for correlations between these factors and MS/effect of drug; 3. To see the effect of the drug;	1 max	Ignore references to confounding variables

9(d)(ii)	1. Teriflunomide produces significant decrease in number of relapses per year (because confidence limits do not overlap with placebo); 2. 7 mg per day/(group) B as effective as 14 mg per day/(group) C (so don't need higher dose) **OR** Two groups/B and C not significantly different; 3. Still get relapses/ only reduces number of relapses/doesn't stop relapses, **OR** Doesn't cure MS; 4. Only 2 years, so results might not be representative / so not enough time to get reliable relapse mean/rate; OR All/placebo below 1 (relapse per year), so many had no relapses and can't tell whether drug worked or not; 5. Only one study, so results unreliable/not representative; **OR** Large sample size, so means/data reliable/representative;	4 max	Reject references to SE and SD once only Ignore 'results' significant/not significant

Question	Marking Guidance	Mark	Comments
10(a)	The control of processes in cells and the importance of these controls. **O** 3.1.3. and 3.2.4. Organelles and processes **T** 3.1.3. Transport across membranes 3.1.3. Cholera **I** 3.1.5. Immune response **M** 3.2.2. Meiosis **C** 3.2.5. Mitosis and cell cycle and DNA replication **Tr** 3.2.7. Passage of water through plant **E** 3.4.2. ATP 3.4.3. Photosynthesis 3.4.4. Respiration **G** 3.2.10. Antibiotics and genetic variation 3.4.8. Inheritance **N** 3.5.1. Receptors 3.5.2. Nerve impulses and synapses **Mc** 3.5.3. Muscle contraction **H** 3.5.4. Control of blood glucose concentration – hormones – plant growth substances **Cd** 3.2.6. Cell differentiation 3.5.6. Polypeptide synthesis and gene mutations **Gt** 3.5.7. Gene expression 3.5.8. Gene therapy	25	**H** If a candidate writes at great length about plant growth substances and hormones, then the topic can be split to allow more credit.

10(b)	The importance of ions in biology. **P** 3.1.3, 3.2.2. Phosphate in structure of phospholipids, structure of membranes, nucleotides, DNA and RNA **T** 3.1.3. Water potentials and osmosis, chloride ions and cholera 3.1.3. Co-transport involving sodium ions **H** 3.2.4. Haemoglobin and iron **Tr** 3.2.7. Passage of water through plants, symplast and root pressure **Ph** 3.4.1. ATP and ADP 3.4.3. Protons in photosynthesis, including reduced NADP and phosphorylated intermediates **R** 3.4.4. Protons in respiration, reduced NADS and FAD and phosphorylated intermediates 3.4.4. Glycolysis and lactate **F** 3.4.5. Use of (NPK) fertilisers 3.4.6. Nitrogen cycle **N** 3.5.1. Chemoreceptors, heart rate and Pacinian function 3.5.2. Nerve impulses and synapses **M** 3.5.3. Calcium ions and muscle contraction, and phosphate from ATP **G** 3.5.8. Genetic fingerprinting, electrophoresis	25	