A-LEVEL
BIOLOGY

BIOL5 – Control in cells and in organisms
Mark scheme

2450
June 2017

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 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

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><td>Type of nucleic acid</td><td>Hydrogen bonds present (√)
Or not present (X)</td><td>Number of polynucleotide strands in molecule</td></tr>
<tr><td>DNA</td><td>√</td><td>2</td></tr>
<tr><td>mRNA</td><td>x</td><td>1</td></tr>
<tr><td>tRNA</td><td>√</td><td>1</td></tr>
</table>
</td><td>2</td><td>One mark for each correct column
Regard blank as incorrect in the context of this question
Accept numbers written out: two, one, one</td></tr>
<tr><td>1(b)</td><td>Correct answer of
UGU UGC UAG
2 marks;
1 mark for correct complementary bases from whole sequence transcribed/intron sequence given;</td><td>2</td><td></td></tr>
<tr><td>1(c)</td><td>(A sequence of) three bases on mRNA that code for an amino acid;</td><td>1</td><td>Accept same statement with DNA</td></tr>
<tr><td>1(d)</td><td>Mutated proto-oncogene ☐
Tumour suppressor gene ✓
Proto-oncogene ☐
Mutated proto-oncogene ☐</td><td>1</td><td>Reject if more than one box ticked</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
2(a)	1. Neurotransmitter only released from pre-synaptic membrane/only vesicles (with neurotransmitter) in pre-synaptic (side); 2. Only receptors for neurotransmitter on post-synaptic (membrane);	2	Accept a named neurotransmitter for either mark point
2(b)	1. (Between A and B) membrane potential falls/reduces/becomes positive/depolarises; 2. (Because) sodium ion channels open; 3. Sodium ions diffuse in;	3	Penalise ref. to sodium on its own once
2(c)	1. Sodium ion channels close **and** potassium ion channels open; 2. Potassium ions diffuse out; 3. Membrane repolarises;	3	Penalise failure to ref. to ions once 3. Accept membrane hyperpolarises / becomes negative

Question	Marking Guidance	Mark	Comments
3(a)(i)	Decreases;	1	Accept any word that means a decrease e.g. shorter/narrower/ smaller etc
3(a)(ii)	Nothing / stays the same length / does not change;	1	
3(b)	29545 to 30455;;	2	Allow one mark for incorrect answers in which candidate clearly divides a measured width by actual width;
3(c)	1. Increase in calcium ion concentration/calcium ions diffuse out of endoplasmic /sarcoplasmic reticulum (at start of contraction); 2. Calcium ions (bind to tropomyosin) cause tropomyosin to move/change shape; 3. Exposes binding sites on actin for myosin/allows formation of actinomyosin bridge;	3	2. Accept troponin for tropomyosin

Question	Marking Guidance	Mark	Comments
4(a)	1. Negative feedback returns to original/normal level/starting point; 2. Positive feedback causes greater movement from original/normal level/starting point;	2	
4(b)	(-)76.5 to (-)79;;	2	Allow one mark answer that clearly show fall divided by starting value
4(c)	1. (Levonorgestrel) prevents/reduces LH; 2. So no ovulation/no egg released; 3. So no egg/nothing to fertilise/meet with sperm;	3	
4(d)	1. (Combined contraceptive pill reduces FSH, so) follicle doesn't mature/ripen/develop; 2. Follicle **doesn't** release oestrogen;	2	1. Do not accept 'less/no stimulation of follicles Accept converse relating to levonorgestrel

Question	Marking Guidance	Mark	Comments
5(a)(i)	1. (Increased temperature) increases rate of reactions / increases kinetic energy / increases metabolism; 2. More energy (from respiration)/more ATP; 3. Oxygen consumption linked to respiration;	3	2. Needs reference to the idea of more.
5(a)(ii)	Units given per gram / per unit mass / mass is standardised / variation in mass taken into account;	1	Accept weight/size. Ignore references to other size-related parameters
5(b)(i)	Further away from the optimum, the greater the movement/least/no movement at optimum;	1	
5(b)(ii)	1. (Outside optimum temperature) moves (between sun and shade); 2. Warm up or cool down / if (too) hot/cold;	2	Accept converse of Does not move; At optimum temperature;
5(c)	1. Evaporation (of water from lining of mouth); 2. Heat transferred from blood;	2	

Question	Marking Guidance	Mark	Comments
6(a)	1. Bind to DNA/gene / specific region/base sequence/promoter sequence; 2. Stimulate transcription / prevents transcription / turn on gene / turn off gene;	2	2. Accept allows RNA polymerase to bind
6(b)(i)	1. Has complementary base sequence;	1	
6(b)(ii)	1. No longer able to make specific protein / cannot make whole protein / mRNA cannot be translated; 2. Because mRNA has been cut (into pieces);	2	1. Reference to transcribes negates this point. 2. Do not accept mRNA destroyed / do not accept gene not expressed. 2. Reject references to target gene broken down.
6(b)(iii)	1. Some diseases are genetic / caused by mutations; 2. siRNA will stop product of this gene / the protein being produced / stops translation;	2	Accept for mark points 1 and 2 1. Some <u>viruses</u> have (an) RNA (genome); 2. siRNA will stop production of DNA / more viruses;

Question	Marking Guidance	Mark	Comments
7(a)(i)	1. Cut plasmid (and allele) with restriction enzyme; 2. Insert (CFTR) gene with ligase; 3. **Correct** reference to **use of** sticky ends;	2 max	3. Ignore allele and plasmid have the same sticky ends
7(a)(ii)	1. Liposomes fuse with cell-surface/plasma membrane of lung cells; 2. Releasing gene/plasmid/allele into cytoplasm/cell;	2	Accept in either order
7(b)	1. (In protein capsule) substance doesn't reach harmful levels/cause side effects; 2. Produces the substance for longer / is effective for longer; 3. Direct injection **and** injection of virus both produce harmful side effects;	3	1. Ignore less/lower side effects

Question	Marking Guidance	Mark	Comments
8(a)	1. (Oxygen/carbon dioxide/pH) detected by chemoreceptors / (pressure) detected by baroreceptors; 2. Correct involvement of Medulla/cardiac centre; 3. **More** impulses to SAN/along sympathetic nerve;	3	2. Accept a valid equivalent e.g. cardioacceleratory centre 3. Neutral: signals/messages/information Accept: acceleratory nerve Need idea of 'more impulses' directly, not by implication
8(b)(i)	1. To ensure results are/change in mean HR is due to omega-3/fatty acids (only) / not due to something else in the oil; 2. Placebo linked to mental/psychological effect;	1 max	Neutral: Idea of comparing groups/results Neutral: reference to a control group / placebo (unqualified)
8(b)(ii)	1. Lower heart rate/greater change of heart rate for Group **X**; 2. (Differences) are real / reliable / significant / not due to chance; 3. As bars do not overlap / values are not shared;	3	Ignore references to methodology 2. Reject results are real / reliable / significant / not due to chance Accept 2. (Differences at 310 and above) are not real / reliable / significant / due to chance; 3. As 2 x SD overlap;

Question	Marking Guidance	Mark	Comments
9(a)	1. No effect at 25°C; 2. More growth at 30°C and 35°C/up to 35°C (more than without GB); 3. Above 35°C, (increase in mass) falls, but grows more than plant without GB;	2 max	The question only refers to plants with GB 1. Reject same mass 2. and 3. Reject either mark point for answers referring to loss/decrease in mass 3. Accept at all temperatures above 25°C more growth than without GB 3. Ignore negative correlation
9(b)(i)	(At high temperatures, rates are) significantly different / SDs do not overlap;	1	
9(b)(ii)	(As temperature increases,) 1. Enzyme activity reduced/(some) enzymes denatured; 2. Less photosynthesis; 3. (So) fewer sugars/glucose/starch/cellulose; 4. Less respiration; 5. Less energy/ATP for growth; 6. Less energy for named function associated with growth	4 max	3. Accept any named (significant) substance 6. Eg mitosis, uptake of mineral ions
9(c)	1. (Rubisco activase attaches to thylakoid and) this changes shape/tertiary structure (of enzyme)/blocks active site/changes active site; 2. (This) prevents substrate/RuBP entering active site/binding;	2	Note – question states enzyme stops working when it attaches to thylakoid, not before 1. Accept rubisco in this context 2. Accept prevents ES complex forming 2. Accept no longer complementary to substrate/RuBP

9(d)	1. GB prevents/reduces binding of rubiscoactivase to (thylakoid membrane); 2. (Prevents it) up to 35°C; 3. (So) rubiscoactivase/enzyme remains active; 4. (So) photosynthesis/light-independent stage still happens; 5. Above 35°C, some binding still occurs but less than without GB, so less reduction in growth;	4 max	1. Accept enzyme instead of rubiscoactivase. 3. Accept rubisco 4. Accept descriptions of light-independent stage
9(e)	1. Looked for information/journals/performed experiments on crop plants that grow at high temperatures/are temperature resistant; 2. (Crop plants cited in this research found to) contain/make GB; 3. So assumed making plants produce GB makes them resistant to high temperatures;	2 max	Ignore simple references to looking at previous studies/other plants – need to relate to this context

Question	Marking Guidance	Mark	Comments
10(a)	**The importance of the specific shapes of molecules in organisms.**	25	
P	**3.1.2** Proteins and enzymes		
C	**3.1.2** and **3.2.4.** Glucose, starch, cellulose		
T	**3.1.3** Plasma membranes and transport across and absorption		
I	**3.1.6** Immune response		
D	**3.2.2** and **3.5.6** DNA, genes and polypeptide synthesis		
M	**3.2.5** and **3.2.10** and **3.5.6** Replication of DNA and mutations		
H	**3.2.4.** Haemoglobin		
Pr	**3.4.3** and **3.4.4** Photosynthesis and respiration		
R	**2.5.1** and **3.5.4** Receptors (and specificity)		
N	**2.5.2** Nerve impulses and synapses		
Mc	**2.5.3** Muscle contraction		
Hf	**3.5.4** and **3.5.5** Hormones and feedback systems		
Ge	**3.5.7** Gene expression		
Gt	**3.5.8** Gene therapy and medical diagnosis		

Question	Marking Guidance	Mark	Comments
10(b)	**The importance of transfers of substances within organisms and between organisms and their environment.**	25	
P	**3.1.1** and **3.1.3** entry of pathogens and effects of cholera		
T	**3.1.3** transfers across membranes		
G	**3.1.4** and **3.2.7** gas exchange		
H	**3.1.5** and **3.2.7** heart and circulation and mass transport, formation and return of tissue fluid		
I	**3.1.6** Immune response		**I** - e.g. transfer of antibody to site of infection/from mother in milk.
C	**3.2.2** and **3.2.5** cell division		
Hb	**3.2.4** haemoglobin		
D	**3.2.5** and **3.5.6** replication of DNA and protein synthesis		
Af	**3.4.1** and **3.4.5** abiotic factors and populations and fertilisers		
Ph	**3.4.3** photosynthesis and limiting factors		
R	**3.4.4** respiration		
E	**3.4.5** energy transfers and food production		**E** - Only in the context of **substances** such as biomass, not general ideas about energy transfer
N	**3.4.6** and **3.4.7** nutrient cycles and succession		
Hr	**3.5.1** and **3.5.4** tropisms (transfer of IAA), receptors and control of heart rate, and homeostasis (blood glucose)		
Ns	**3.5.2** nerve impulses and synapses		
M	**3.5.3** muscle contraction		
F	**3.5.5** feedback (involving transfers of, e.g. hormones)		