GradeMax



# Mark Scheme (Results)

## January 2021

Pearson Edexcel International Advanced Level In Biology (WBI15)
Paper 01 Respiration, Internal Environment, Coordination and Gene Technology

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**General Marking Guidance**

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

| Question number | Answer | Mark |
|---|---|---|
| **1(a)(i)** | A -70 mV<br><br>B is not correct as -78 mV is the potential when the axon is hyperpolarised<br><br>C is not correct as 38 mV is the action potential<br><br>D is not correct as 108 mV is the change in potential from resting to action potential | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **1(a)(ii)** | C voltage-gated potassium ion channel only<br><br>A is not correct as the voltage-gated sodium ion channels will be closed and the potassium ion channels open at Y<br><br>B is not correct as the voltage-gated sodium ion channels will be closed and the potassium ion channels open at Y<br><br>D is not correct as the voltage-gated sodium ion channels will be closed and the potassium ion channels open at Y | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **1(a)(iii)** | B hyperpolarised<br><br>A is not correct as the membrane at Z is hyperpolarised<br><br>C is not correct as the membrane at Z is hyperpolarised<br><br>D is not correct as the membrane at Z is hyperpolarised | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **1(a)(iv)** | B one<br><br>A is not correct as only the third statement is correct.<br><br>C is not correct as only the third statement is correct<br><br>D is not correct as only the third statement is correct | **(1)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **1(b)** | An explanation that includes the following points:<br><br>• because ATP is used by the sodium-potassium pump (1)<br><br>• to move sodium ions and potassium ions across the cell membrane (1)<br><br>• to establish concentration gradients for sodium ions and potassium ions (1) | | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(a)** | A calculation in which:<br><br>• correct percentage increase from the graph (1)<br><br>• increase in strength correctly calculated (1)<br><br>• muscle strength correctly calculated and answer given to 3 significant figures (1) | 27.5<br><br>(27.5 x 12.5) ÷ 100 = 3.4375<br><br>12.5 + 3.4375 = 15.9<br><br>Correct answer with no working gains all three marks | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(b)(i)** | A description that includes three of the following points:<br>• less myoglobin (1)<br>• fewer mitochondria (1)<br>• more sarcoplasmic reticulum (1)<br>• higher glycogen content (1) | | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(b)(ii)** | An answer that includes three of the following points:<br>• training increases muscle strength and cross-sectional area (1)<br>• no effect on slow twitch fibres (1)<br>• causes fast fibres to switch to intermediate twitch fibres (1)<br>• greater the exercise the greater the switch (1) | | **(3)** |

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th></th><th></th><th></th></tr>
<tr><td>P</td><td>medulla oblongata</td><td>non-conscious regulation of body processes / example of process regulated by medulla</td></tr>
<tr><td>Q</td><td>hypothalamus</td><td>homeostasis / thermoregulation</td></tr>
<tr><td>R</td><td>cerebellum</td><td>balance and coordinating movement</td></tr>
</table>
</td><td>One mark for two correct cells<br><br>Accept<br>osmoregulation</td><td>(2)</td></tr>
</table>

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **3(b)(i)** | C CT scans produce a cross sectional image of a thin slice through the body | | **(1)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **3(b)(ii)** | A description that includes three of the following points:<br>• isotope {that emits positrons / is incorporated into glucose} (1)<br>• more active neurones with increased respiration (1)<br>• will require increased supply of glucose (1)<br>• positrons (emitted from glucose) produce gamma rays that detected and are converted into an image (1) | Accept suitable named isotope e.g. carbon-11 or oxygen-15, radioactive material in glucose<br>Accept will {absorb/use} more glucose | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **3(c)** | An answer that includes the following points:<br>• {impulses / electrical activity} from the neurones at site of seizure (1)<br>• {arrive at / travel to} the thermoregulatory centre in the hypothalamus (1)<br>• description of consequence that would lead to increased body temperature (1) | ACCEPT impulses travel to sweat glands<br>e.g. reduce sweating / increase metabolic rate<br>increased respiration | **(3)** |

| Question number | Answer | Mark |
|---|---|---|
| **4(a)(i)** | B myosin<br><br>A is not correct because the structure labelled X is made from myosin not actin<br><br>C is not correct because the structure labelled X is made from myosin not tropomyosin<br><br>D is not correct because the structure labelled X is made from myosin not troponin | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **4(a)(ii)** | D Z<br><br>A is not correct because the structure labelled W does not change in length during contraction<br><br>A is not correct because the structure labelled X does not change in length during contraction<br><br>A is not correct because the structure labelled Y does not change in length during contraction | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **4(a)(iii)** | D three<br><br>A is not correct as all three statements are correct.<br><br>B is not correct as all three statements are correct.<br><br>C is not correct as all three statements are correct. | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **4(a)(iv)** | B myosin<br><br>A is not correct because actin does not have an enzyme activity that breaks down ATP<br><br>C is not correct because tropomyosin does not have an enzyme activity that breaks down ATP<br><br>D is not correct because troponin does not have an enzyme activity that breaks down ATP | **(1)** |

| Question number | Answer | Mark |
|---|---|---|
| **4(b)** | Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.<br><br>The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant.<br><br>**Indicative content**<br><br>Descriptive points<br>- individual 1 no treatment stimulated normal oxygen consumption<br>- individual 2 pyruvate all three treatments stimulated normal oxygen consumption<br>- individual 3 succinate and reduced TMPD stimulated normal oxygen consumption<br>- individual 4 only reduced TMPD stimulated normal oxygen consumption<br><br>Linking treatments to activation of different points in etc<br>- pyruvate and malate (produce reduced NAD) acts on (complex) I<br>- succinate acts on (complex) II<br>- reduced TMPD acts on cytochrome c<br><br>Links to etc defect<br>- idea that defects in different parts of etc<br>- individual 1 defect is in or after cytochrome c<br>- individual 2 defect is in before (complex) I / etc is intact<br>- individual 3 defect is in (complex) I<br>- individual 4 defect is in (complex) I, coQ or III (Ignore complex II) | **(6)** |

| Level | Marks | Descriptor |
|---|---|---|
| | 0 | No awardable content. |
| 1 | 1-2 | An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information.<br><br>The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context. |
| 2 | 3-4 | An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.<br><br>The explanation shows some linkages and lines of scientific reasoning with some structure. |
| 3 | 5-6 | An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information.<br><br>The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured. |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **5(a)** | An explanation that includes three of the following points:<br>• active site no longer complementary to trans-retinal (1)<br>• cis-retinal cannot be regenerated (1)<br>• therefore, rhodopsin cannot be formed (1)<br>• and rod cells will not have any photoreceptor (1) | | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **5(b)** | An answer that includes the following points:<br>• increasing the dose of gene therapy increased cis-retinal in the eye (1)<br>• the RPE65 gene enables the conversion of trans-retinal to cis-retinal (1)<br>• increasing the dose of gene therapy increased the ability to follow a path (1)<br>• the production of cis-retinal restores vision (1)<br>• reference to error bars used to support conclusions (1) | Accept increasing the dose of gene therapy does not alter trans-retinal very much in the eye | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **5(c)** | A description that includes the following points:<br><br>• use microarray techniques to identify genes that are actively transcribed in the eye (1)<br><br>• sequencing the genome of individuals with inherited forms of blindness (1)<br><br>• compare the sequences for active genes from a large number of individuals with and without blindness to identify mutations (1) | | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **6(a)** | An answer showing the following steps:<br><br>• correct figures taken from graph (1)<br><br>• correct calculation of percentage change (for fit person) (1)<br><br>• correct difference given to an appropriate number of decimal places (1) | 170 – 90<br>ACCEPT 80<br><br>((170 – 90) ÷ 170) x 100 = 47.06 %<br><br>47.06 – 16 = 31.06 %<br><br>Final answer 31 %<br><br>ACCEPT 31.1 % | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **6(b)** | An answer showing the following steps:<br><br>• value of mx (1)<br><br>• value of y (1)<br><br>• correctly rounded to a whole number with units (1) | (-65 ÷ 240) × 300<br>= -81.25<br><br>= (-65 ÷ 240 × 300) + 190 = 108.75<br><br>109 bpm<br>Accept range 107-111 | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **6(c)** | An explanation that includes three of the following points:<br>• fit person has greater lung capacity (1)<br>• fit person (can produce) a greater cardiac output (1)<br>• more effective gas exchange and transport of oxygen to muscles (1)<br>• therefore more rapid reduction of oxygen debt (1) | | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **6(d)** | A description that includes the following points:<br>• cardiovascular control centre in the medulla oblongata (1)<br>• detects change in blood pH (following exercise) (1)<br>• as blood pH increases (more) impulse are sent via the parasympathetic nerve (1)<br>• slowing (the rate of impulses from) the SAN (1) | Accept increase in lactate / $CO_2$<br>Accept vagus nerve | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **7(a)(i)** | A description that includes four of the following points:<br><br>• impulse (arriving) at the pre-synaptic knob opens (voltage-gated) calcium ion channels (1)<br><br>• calcium ions diffuse in and cause vesicles containing neurotransmitter to fuse with the presynaptic membrane (1)<br><br>• neurotransmitter is released into the synaptic cleft and binds to receptors on postsynaptic membrane (1)<br><br>• opening (ligand-gated) sodium channels (1)<br><br>• depolarising the membrane and initiating an action potential (1) | | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **7(a)(ii)** | A description that includes three of the following points:<br><br>• (in Parkinson's disease) dopamine producing cells in the motor cortex die (1)<br><br>• L-DOPA crosses the blood brain barrier (1)<br><br>• in the brain L-DOPA is converted to dopamine (1)<br><br>• restoring control of muscle movement (1) | ACCEPT in basal ganglia / in midbrain<br><br>ACCEPT replacing the dopamine lost in the motor cortex | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **7(b)(i)** | An explanation that includes two of the following points:<br><br>• (transcription factors) bind to {DNA / genes} involved in the synthesis of dopamine(1)<br><br>• allowing mRNA synthesis (1)<br><br>• that is translated to produce the enzymes that synthesise dopamine (1) | ACCEPT gene/promotor region of DNA for dopamine<br><br>ACCEPT RNA polymerase binding / forming a transcription initiation complex | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **7(b)(ii)** | An answer that includes the following points:<br><br>• both mean number and length of dendrites decrease in LRRK2 and Parkinson's Disease neurones compared with the control neurones (1)<br><br>• the error bars do not overlap between people without Parkinson's disease and those with Parkinson's disease (1)<br><br>• the error bars overlap between Parkinson's disease and LRRK2 neurones (1)<br><br>• the number of dendrites are the same for both Parkinson's groups but the length is longer in the LRRK2 group | ALLOW the difference is statistically significant<br><br>ALLOW the differences are not statistically different between different causes of Parkinson's | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(a)** | A description that includes two of the following points:<br>• taken up by capillary endothelial cells (1)<br>• (virus) replicates in (endothelial cells) causing cell lysis (1)<br>• creating (large) gaps in the capillary wall (1) | | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(b)** | An explanation that includes four of the following points:<br>• antigens are taken up by {macrophages / APC} by phagocytosis (1)<br>• antigens are presented (by macrophages) to T helper cells (1)<br>• activated T helper cells release cytokines to activate B cells (1)<br>• B cells differentiate into plasma cells that release antibodies (1)<br>• B memory cells are developed (1) | ACCEPT antigen engulfed by macrophage | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(c)** | An answer that includes two of the following points:<br><br>• sugar molecules are bonded to the vaccine molecules by hydrogen bonds (1)<br><br>• (therefore when excess) water is added the water molecules form hydrogen bonds with sugar molecules / vaccine molecules releasing the vaccine (1)<br><br>• and the vaccine molecules can dissolve in the water (1) | Accept sugar dissolves in water releasing vaccine | **(2)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(d)** | An explanation that includes the following points:<br><br>• each time the virus replicates mutations may occur (1)<br><br>• the more mutations that take place the greater the number of changes in the amino acid sequence of the virus coat proteins (1)<br><br>• immune response is specific and will not produce antibodies against the Ebola virus (1) | Accept during replication of the virus mutations occur | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(e)(i)** | A description that includes the following points:<br>• Ebola virus antigen is a protein (1)<br>• isolate / synthesise the gene coding for Ebola virus antigen (1)<br>• insert the gene into a vector (1)<br>• description of method of putting the vector into the insect cell (1) | Plasmid/bacterial or viral vector, liposome<br>Micro-injection / gene gun / heat shock | **(4)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(e)(ii)** | A description that includes the following points:<br>• it is safer to use genetically modified insect cells than the Ebola virus (1)<br>• insect cells are eukaryotic cells / contain endoplasmic reticulum and Golgi apparatus (1)<br>• when the vaccine protein is made in insect cells it will be (properly) {glycosylated / post transcriptionally modified} (1)<br>• (insect cells) have a low mutation rate (1) | Accept less chance of a mutation | **(3)** |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **8(f)** | An explanation that includes the following points:<br><br>• different regions of nucleic acid code for the stem and the head (1)<br><br>• there is only one version (of nucleic acid) coding for the stem but many versions for the head (1)<br><br>May need to accept explanations in terms of post-transcriptional modification<br><br>• splicing of the gene for haemagglutinin (1)<br><br>• same exons used for the stem and different exons used to code for head (1) | ALLOW There are more mutations in the gene(s)<br>for the head than in the gene(s) for the stem<br>( for 2 marks) | **(2)** |

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