Pearson Edexcel

Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International Advanced Level
In Biology (WB15) 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

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
• an idea of the types of response expected
• how individual marks are to be awarded
• the total mark for each question
• examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer. ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
• write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear · select and use a form and style of writing appropriate to purpose and to complex subject matter · organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>1(a)</td><td>An answer that includes the following points:

• glycolysis completed correctly (1)

• Krebs cycle completed correctly (1)

• Oxidative phosphorylation completed correctly (1)</td><td>Accept products written in long hand eg Adenosine Triphosphate.

<table><tr><th>Stage</th><th>One other product</th></tr><tr><td>glycolysis</td><td>pyruvate / reduced NAD/NADH</td></tr><tr><td>Krebs cycle</td><td>reduced NAD/NADH/FAD/FADH carbon dioxide/CO_2</td></tr><tr><td>oxidative phosphorylation</td><td>water / H_2O/ NAD/FAD</td></tr></table></td><td>(3)</td></tr>
</table>

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>1(b)(i)</td><td>An answer that includes the following points:

• correct number 80 O_2 (1)

• correct number 57 CO_2 (1)</td><td></td><td>(2)</td></tr>
</table>

Question number	Answer	Additional guidance	
1(c)(i)	Choose an item. Correct answer C A is incorrect as energy is not released from ATP in the conversion of ADP to ATP B is incorrect as energy is not released from ATP in the phosphorylation of ADP D is incorrect as energy is not released from ATP in the loss of adenosine molecules from ATP		(1)

Question number	Answer	Additional guidance	
1(c)(ii)	A calculation showing the following steps: • calculation of energy from 38 ATP (1) • calculation of percentage of energy from glucose (1)	38 x 30.51 (1159.38) (1159.38/2867.48 x 100) = 40.43% Accept 40.4 Do not accept 40.5 or 40 Correct answer without working gains 2 marks	(2)

Question number	Answer	Additional guidance	Mark
1(c)(iii)	An answer that includes the following points: • lost as heat (1) • increasing body temperature (1)	Both points may be in the same sentence	(2)

Question number	Answer	Additional guidance	Mark
1(d)	A description that includes two of the following points: • oxygen is terminal electron acceptor / accepts electrons from electron transport chain (1) • forms H_2O / accepts H^+ from reduced NAD/FAD (1)	**Accept** electrons cannot be passed along electron transport chain if no O_2 to accept them (1)	(2)

Question number	Answer	Additional guidance	Mark
2(a)(i)	Choose an item. D sensory neurone is correct A is not correct because a motor neurone does not continue a reflex action after the receptor. B is not correct because the relay neurone does not continue a reflex action after the receptor. C is not correct because a Schwann cell does not continue a reflex action after the receptor.		(1)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	Choose an item. C is the correct answer receptor → spinal cord → muscle B is not correct because muscle → receptor → brain is not the correct pathway C is not correct because muscle → spinal cord → brain is not the correct pathway D is not correct because spinal cord → brain → Muscle is not the correct pathway.		(1)

Question number	Answer	Additional guidance	Mark
2(b)(i)	A description that includes three of the following points: • reference to use of sodium potassium pump (1) • the sodium ion channels are closed (1) • the membrane is relatively permeable to potassium ions (1) • at rest high potassium ions (K^+) inside the axon, high sodium ions (Na^+) outside axon (1)	Potassium channels open	(3)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An answer that includes the following points: • pressure deforms cell membranes in the Pacinian corpuscle (1) • an influx of sodium ions into the axon (1) • details of the (action potential in the axon) (1)	Accept disrupts, changes cell membrane Do not accept damages If they refer to opening the sodium channels it could be an alternative to second point	(3)

Question number	Answer	Additional guidance	Mark
2(b)(iii)	An answer that includes three of the following points: • the threshold (potential) has been reached (1) • results in action potential (1) • action potentials are all or nothing (1) .	Accept since either they occur fully or they do not occur at all	(3)

Question number	Answer	Additional guidance	Mark
3(a)	An explanation that includes three of the following points: • the myelin sheath is an (electrical) insulator (1) • therefore the action potential only occurs at nodes of Ranvier (1) • and therefore the nerve impulse 'jumps' from one node to the next / reference to saltatory conduction (1)	**Accept** The influx of sodium ions at one node creates enough depolarization to reach the threshold of the next.	(3)

Question number	Answer	Additional guidance	Mark
3(b)	An answer that includes two of the following points: • when the myelin sheath is destroyed transmission of the nerve impulse is impaired (1) • fewer nerve impulses reach the muscle (1) • fewer muscle fibres are stimulated to contract which leads to muscle weakness (1)	Accept suggestion impulse is slower as myelin destroyed	(2)

Question number	Answer	Additional guidance	Mark
3(c)	An answer that includes two of the following points: • all types of dementia have a lower level of myelin than the control group (1) • there is no relationship between the amount of myelin in the brain and the type of dementia (1) • no overlap in any of the standard deviation for any type of dementia and control which suggests that the conclusions may be valid (1)	Accept converse if correct figures used	(2)

Question number	Answer	Additional guidance	Mark
4(a)	A 1 is the correct answer B not 2 as only the collecting duct is affected by ADH C not 3 as only the collecting duct is affected by ADH D not 4 as only the collecting duct is affected by ADH		(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	• ultrafiltration	Accept glomerular ultrafiltration	(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	• microvilli		(1)

Question number	Answer	Additional guidance	Mark
4(c)(i)	A calculation that has the following stages: • Correctly calculating the radius (1) • Correctly calculating the cross-sectional area (1)	2.355, accept 2.36 17.43, accept 17.5	(2)

Question number	Answer	Additional guidance	Mark
4(c)(ii)	• Correct calculation of the difference, must include the correct units (1)	1.97, difference in mm^2 0.0197, difference in cm^2, accept 0.02. Allow ECF from 4(c)(ii)	(1)

Question number	Answer	Additional guidance	Mark
4(d)	An answer that includes three of the following points: • proximal tubule has role in selective reabsorption (1) • named relative concentration change by reabsorption (1) • comment on protein channels for reabsorption/ suggested mechanism for reabsorption (1) • named relative concentration change by secretion (1)	 e.g. 100% of glucose e.g. 70x increase for urea	(3)

Question number	Answer	Additional guidance	Mark
4(e))	A two-step calculation: • Calculation of urine in one hour (1) • Correct total for 24 hours to two s.f. (1)	 (0.83 x 60 = 49.8) (Accept 60x24x0.83) 1195.2 for one mark 1.2dm^3	Graduate (2)

Question number	Answer	Additional guidance	Mark
5(a)(i)	Choose an item. C is the correct answer as habituation is a long term physical change D is not the correct answer as sensitisation is a learning process resulting in amplification of a response B is not the correct answer as absorption relates to fluid movement A is not the correct answer as adaptation is a change in behaviour		(1)

Question number	Answer	Additional guidance	Mark
5(a)(ii)	Choose an item. A is the correct answer B is not the correct answer C is not the correct answer D is not the correct answer		(1)

Question number	Answer	Additional guidance	Mark
5(b)(i)	An answer that includes three of the following points: • male and female crabs respond differently to the predator (1) • female crabs showed greater habituation than male crabs (1) • after 10 exposures there seems to variability in the data (1) .		(3)

Question number	Answer	Additional guidance	Mark
5(b)(ii)	Choose an item. A is the correct answer because correlation being tested. B is not the correct answer as Hardy-Weinberg does not test a correlation. C is not the correct answer as index of diversity does not test a correlation D is not the correct answer as Student t test does not test a correlation		(1)

Question number	Answer	Additional guidance	Mark
6(a)(i)	Choose an item. B Q is the SAN and P is the AVN A is not correct because R is not the AVN C is not correct because Q is not the bundle of His D is not correct because P is not the Purkinje fibres		(1)

Question number	Answer	Additional guidance	Mark
6(a)(ii)	Choose an item. B myogenic A is not correct because diastole is when the heart muscle relaxes C is not correct because polarisation is where there is a difference in electrical charge between inside and outside of a cell D is not correct because systole is when the heart muscle contracts		(1)

Question number	Answer	Additional guidance	Mark
6(b)(i)	A explanation that includes the following points: • cardiovascular control centre detects a drop in pH of blood (or increased CO_2) (1) • therefore SAN (stimulated) to generate more impulses per second (1) • therefore the cardiac cycle is shorter (1)	Accept reference to carotid / aortic bodies	(3)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	A calculation showing the following step: • Correct calculation of stroke volume	 (4500/51) 88.24 Accept 88.2	 (1)

Question number	Answer	Additional guidance	Mark
6(b)(iii)	A calculation showing the following steps: • correct calculation of heart beat in unit time. (1)	 Eg 18 beats in 7 seconds 60/7 x 18 = 154.3 = 154 Do not accept fraction of heart rate.	 (1)

Question number	Answer	Additional guidance	Mark
6(b)(iv)	An answer that includes three of the following points: • comment on the wave pattern of the two traces (1) • comment on the frequency of heart rate in the two traces (1) • comment on the size of the R wave (1) • comment on the ST segment of the wave (1)	For each mark there must be a clear comparison between the two ecgs. Eg more normal (PQRST) wave pattern in second trace Accept wave pattern is different Eg less heart beats in second trace Accept reference to correct figures Eg R wave higher in first trace Eg no clear S segment in first trace	(3)

Question number	Answer	Additional guidance	Mark
7(a)(i)	An explanation that includes four of the following points: • circular muscles contract **and** radial muscles relax (1) • circular muscles arrange in concentric rings around pupil **and** radial muscles run radially (1) • pupil reflex is the reflex contraction and relaxation of the antagonistic muscles of the iris (1) • therefore pupil becomes smaller so less light enters the eye. (1)	ignore reference to photoreceptors accept diagram	(3)

Question number	Answer	Additional guidance	Mark
7(a)(ii)	A description that includes three of the following points: • (rhodopsin) absorbs light (1) • (rhodopsin) splits into opsin and retinal (1) • sodium ions are not taken up (1) • causing hyperpolarisation (1)		(4)

Question number	Answer	Mark
7(b)	**Indicative content** **Description of named responses** • Many different photoresponses that affect the growth and development of plants. • Light triggering key events in a plants growth and development – photomorphogenesis. • Photoperiodisms – a physiological response to photoperiods eg seed germination. **Chemical nature of responses** Photoreceptor receive light, reacts to it and initiates a response. Phytochromes regulate many other responses to light eg seed germination.	(6)

- Seeds need sunlight to grow. Far-red light makes plants think they are not getting sunlight. As a result, too much far-red on your seedlings may prevent germination altogether.
- There are two forms of phytochrome. These are Pr and Pfr. These two pigments differ in their absorption peak.

- **Phytochrome red (Pr):** It absorbs maximum light in the red region of the spectrum. It has wavelength of 660p Pr is the inactive form.
  2.Phytochrome far red (Pfr): It has the absorption peak in the far-red region at 730 p. Only Pfr phytochrome is physiologically active.

- Metabolic activity and mitosis in embryos are stimulated by red light and inhibited by far-red light in light-sensitive seeds.

- plants also use light as a source of information, allowing for the adjustment of growth and development in response to changing environmental conditions. This process, termed photomorphogenesis, is regulated by a suite of photoreceptors

Detailed mechanism of responses

- Photoreceptor receive light, reacts to it and initiates a response
- Phytochrome red (Pr)**:** It absorbs maximum light in the red region of the spectrum. It has wavelength of 660p Pr is the inactive form.
  Phytochrome far red (Pfr): It has the absorption peak in the far-red region at 730 p. Only Pfr phytochrome is physiologically active.
- Phytochrome has two identical subunits. The chromophore of the phytochrome is photoreversible between the two isomers depending on the wavelength of light.
- Subcellular circadian rhythms include cycles in gene regulation (at the levels of transcription, transcript abundance, translation, and post-translational modification).
- Germination stimulated by the hormone gibberellin.

	• Phytochrome red stimulates transcription. • Leads to production of enzymes that metabolise active forms of gibberellins. Level 1: Description of (a minimum of 2 specific) results from experimental data. eg. more exposure to far red light at all red light times reduces percentage germination. Less exposure to far red light increases percentage of germination in general. Level 2: Reference to specific chemical nature of the effect of red light and far red light on germination. Level 3: Detailed mechanism for at least 1 photo-response at a sub-cellular level eg. Effect on transcription.	

Question number	Answer	Additional guidance	Mark
8(a)	A description that includes three of the following points: • a muscle fibre is a single cell (1) • a (skeletal) muscle cell which is multinucleate(1) • striated appearance due to repeating bands of actin and myosin (1) • actin and myosin alternate to form the sarcomere (1)	Accept suitably labelled diagram. Accept reference to sarcomere.	(3)

Question number	Answer	Additional guidance	Mark
8(b)	An explanation that includes three of the following points: • because myokines are released in response to muscle contraction (1) • because they travel in blood (1) • stated effect on the liver (1) • therefore myokines have direct effect on muscle (1)	e.g. Effects on metabolism, stimulation of respiration, increased fat metabolism, glycogenesis, and regulation of homeostasis.	(3)

Question number	Answer	Additional guidance	Mark
8(c)	An explanation that includes four of the following points: • because loss of muscle mass (makes movement more difficult) (1) • because reduced muscle strength (makes moving from the seated position a challenge) (1) • correct reference to slow and fast twitch muscle fibres. – decrease in fast twitch fibres and an increase in slow twitch fibres (1) • reduction in speed of action/ response due to less muscle innervation (1)	Responses must be a clear comparison either in one sentence or in adjacent sentences. Accept correct reference to sarcopaenia Accept fewer muscle fibres (and an increase in fat and connective tissues)	(4)

Question number	Answer	Additional guidance	Mark
8(d)	An explanation that includes three of the following points: • this causes change in shape of tropomyosin (1) • exposing myosin binding site (1) • allowing formation of myosin and actin cross bridges (1) • ATP breakdown releases energy which allows myosin to pull the actin inwards, causing shortening.(1)	accept power stroke	(3)

Question number	Answer	Additional guidance	Mark
8(e)	An explanation that includes three of the following points: • names of two or more 'high energy phosphate' compounds involved in muscle contraction (1) • hydrolysis of phosphate bond in ATP to release energy (1) • creatine phosphate provides phosphate to ADP to produce more ATP (to continue contraction) (1)	ATP, ADP, creatine phosphate (phosphocreatine) ATP in muscle releases energy for myosin to pull the actin molecule	(2)

Question number	Answer	Additional guidance	Mark
8(f)	An answer that includes three of the following points: • reduction in (contractile) force at the joint (1) • caused by a change in make up of a tendon (1) • effect on movement at the joint (1)	 Accept results in loss of collagen / increase in elastin/reduction in extracellular water content more unwanted movement less desired movement caused by 'soft' tendon	(3)

Question number	Answer	Additional guidance	Mark
8(g)	An answer that includes two of the following points: • acts as a transcription factor (1) • inhibits myogenesis / muscle growth / cell differentiation (1) • promotes muscle wasting (1)	 reference to proteases that break down muscle protein	 (2)

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