GradeMax



Mark Scheme (Results)

January 2022

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	Additional guidance	
1(a)	A calculation showing the following step: • width mm/length mm (1) • x actual length nm (1)	(24.5/75) = 0.33 (0.33 x 2000) = 653 accept 24/25 as width 75/76/77 as length range 619 - 667	(2)

Question number	Answer	Additional guidance	
1(b)	A description that includes three of the following points: • reference to chemiosmosis (1) • electrons passed between (electron carriers / electron acceptors) releasing energy (1) • energy used to move protons (out of matrix) into inter membranal space (1) • role of stalked particle in generation of ATP from ADP and Pi (1)	electrons passed along ETC correct reference to ATP synthase in generation of ATP	(3)

Question number	Answer	Additional guidance	
1(c)	A description that includes two of the following points: • hydrolysis of {ATP / bonds}(1) • releases energy (1)		(2)

Question number	Answer	Additional guidance	Mark
2 (a)(i)	An answer that includes the following point: B is the correct answer A is not the correct answer as cartilage is a structural tissue of the body C is not the correct answer as synapses are part of the nervous system D is not the correct answer as tendons join muscle to bone.		(1)

Question number	Answer	Additional guidance	Mark
2 (a)(ii)	An answer that includes the following point: B is the correct answer • A only the first statement is correct • C only the first statement is correct • D only the first statement is correct		(1)

Question number	Answer	Additional guidance	
2(b)(i)	An answer that includes the following point: D is the correct answer • A is not the correct answer as myoglobin is not an enzyme • B is not the correct answer as myoglobin is not part of the sarcolemma • C is not the correct answer as myoglobin does not act as an immediate source of energy		(1)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation that includes three of the following points: • as sprinting demand fast speed (over a short distance/ in a short time) (1) • because fast twitch fibres contract more quickly (than slow twitch) (1) • because fast twitch rely on anaerobic respiration (to supply the energy for contraction) (1)	accept fast / quick accept contraction of fast twitch fibres does not rely on a supply of oxygen	(3)

Question number	Answer	Additional guidance	Mark
2(c)	An answer that includes three of the following points: • heart rate and lactate increase with increasing speed (1) • lactate increases more at higher speeds / heart rate increases more at lower speeds (1) • the (relative) change in lactate is greater than the (relative) change in heart rate (1)	can piece together e.g. heart rate increased by 22.5% and lactate increased by 308.5% only accept comparison at 8-20	(3)

Question number	Answer	Additional guidance	Mark
3(a)(i)	An answer that includes the following point B is the correct answer • A is not the correct answer • C is not the correct answer • D is not the correct answer		(1)

Question number	Answer	Additional guidance	Mark
3(a)(ii)	An answer that includes the following point: B is the correct answer • A is not the correct pathway • C is not the correct pathway • D is not the correct pathway		(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	An answer that includes three of the following points: • heart rate decreases when diving (1) • the longer the whale is diving the lower the heart rate (1) • the difference between maximum heart rate at the surface and minimum heart rate in dive increases as dive duration increases (1)	accept ref to max and min HR	(3)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer that includes three of the following points: • relevant physiological change during a dive described (1) • {pH/oxygen / carbon dioxide concentrations} in the blood monitored by {chemoreceptors /sensors} (1) • increase in impulses from medulla to SAN (1) • increase impulses from SAN leading to increased heart rate (1)	E.g. blood oxygen decreases / {CO_2/lactate} increases /pH decreases / oxygen debt develops accept increased depolarisations	(3)

Question number	Answer	Additional guidance	Mark
4(a)(i)	An answer that includes the following points: • correct location of the Bowman's capsule (1)		(1)

Question number	Answer	Additional guidance	Mark
4(a)(ii)	An answer that includes the following point: D is the correct answer • A is not the correct answer as collecting duct collects urine from the nephrons • B is not the correct answer as the distal tubule is responsible for salt and water reabsorption • C is not the correct answer as the loop of Henle is responsible for salt and water reabsorption		(1)

Question number	Answer	Additional guidance	Mark
4(a)(iii)	An answer that includes the following point: B is the correct answer • A is not the correct pathway • C is not the correct pathway • D is not the correct pathway		(1)

Question number	Answer	Additional guidance	Mark
4(b)	An explanation that includes four of the following points: • flow of filtrate in tubules in opposite direction (1) • because sodium ions actively transported out of the ascending limb (1) • therefore water out from descending limb (and solutes from ascending limb) (1) • due to increase in concentration gradient between tubular fluid and interstitial space (1)		(4)

Question number	Answer	Additional guidance	Mark
4(c)	A description that includes four of the following points: • water potential of blood monitored by osmoreceptors in hypothalamus (1) • release of ADH from (hypothalamus) pituitary gland (1) • (in blood to kidneys)where ADH acts on {collecting ducts / distal convoluted tubul}) (1) • increase in permeability to water of cell membranes (1) • more water reabsorbed so water potential of blood back to normal range (1)	Accept insertion of aquaporins into cell membranes (of CT and DCT)	(4)

Question number	Answer	Additional guidance	Mark
5(a)(i)	An answer that includes the following points C is the correct answer • A is not the correct answer as the iris does not have rod cells • B is not the correct answer as the pupil does not have rod cells • D A is not the correct answer as the spinal cord does not have rod cells		(1)

Question number	Answer	Additional guidance	Mark
5(a)(ii)	A description that includes three of the following points: • rhodopsin is the {photoreceptor / photosensitive pigment} (1) • when light absorbed cis retinal (+ opsin) is converted to trans retinal (+ opsin) (1) • causes sodium channels to close (1) • membrane becomes hyperpolarised (1)	accept absorbs light accept Na^+ gated channels blocked	(3)

Question number	Answer	Additional guidance	Mark
5(b)	An answer that includes the following points: Indicative content – description from experimental data experiment 2 shows that substance responsible for phototropism passes through gel but not plastic experiment 1 shows that cause of phototropism is chemical in nature and is produced in the tip experiment 3 chemical substance can diffuse and cause curvature even in the dark Chemical nature of responses phototropism caused by auxins receptor proteins (phototropins) activate several hormones including auxin Auxin transported down dark side and less on bright side Auxin stimulates elongation on shaded side to give curvature Detailed mechanism of responses Auxin stimulates decrease in cell pH which activates enzymes responsible for cell growth and elongation Auxin affects hydrogen ion pumps (proton pumps) Auxin causes intracellular reserves of hydrogen ions to increase which lowers the pH on dark side lower pH activate enzymes these disrupt hydrogen cross links in cell wall increased osmotic gradient due to movement of solutes water enters cell (and increased turgor pressure) leads to swelling of cell Level 1: Discuss some of the results from experimental data. Level 2: Discuss all of level 1 plus reference to specific chemical nature of phototropism Level 3: Discuss all of level 2 plus detailed mechanism for phototropism at molecular level		(6)

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Question number	Answer	Additional guidance	Mark
6(a)	An answer that includes the following point: A is the correct answer • B is not the correct answer as adenosine diphosphate is a high energy phosphate compound • C is not the correct answer as adenosine triphosphate is a high energy phosphate compound • D is not the correct answer as cholesterol is a component of membranes		(1)

Question number	Answer	Additional guidance	Mark
6(b)	An explanation that includes two of the following points: • stimulus initiates change in (voltage / membrane potential)(1) • sodium ion channels open / sodium ions rush in causing membrane potential to become less negative (1) • if above threshold potential depolarisation initiated (1)	Stimulus cause change from resting potential	(2)

Question number	Answer	Additional guidance	Mark
6(c)(i)	A calculation showing the following steps: manipulation of equation to get m as subject (1) calculation of gradient for myelinated fibres using equation (1) calculation of percentage difference between gradients (1)	m=(y-c) ÷ x (120-0/20) = 6 (6- 0.5) ÷ 0.5 x 100 = 1100% accept range 1050-1150 Correct answer gains full marks	(3)

Question number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that includes three of the following points: • myelin (covers axon) and acts as an insulator (1) • {myelinated fibres have regular gaps / nodes of Ranvie}r along axon where action potential occurs (1) • nerve impulse jumps {from node to node/ in saltatory conduction) (1)	accept opening of gated channels at nodes of Ranvier where action potential occurs	(3)

Question number	Answer	Additional guidance	Mark
6(d)	A description that includes four of the following points: • radioactive tracer added with glucose (and injected into blood stream) (1) • (carried to brain and) taken up by active (respiring) cells (1) • (sensors in)PET scanner detect radioactivity (in different regions of the brain) (1) • build up (2D or 3D) images to show where cells stimulated (by cocaine) are found (1) • the PET shows more regions taking up radio activity in the(cocaine) brain (1)	accept added to water accept gamma rays	(4)

Question number	Answer	Additional guidance	Mark
7(a)	A calculation showing the following steps: • determination of tidal volume (1) • calculation of volume of air in 1 min (1) • calculation of volume of air in one hour (1)	(500-150) = 350 350 x 12 = 4.2 (dm^3 min^{-1}) Accept 4200 (cm^3 min^{-1}) (4.2 x 60) = 250 dm^3 $hour^{-1}$ Accept (4200 x 60) = 250000 cm^3 ($hour^{-1}$) max 2 marks if no units / or incorrect units accept answer in standard form 2.5×10^5	(3)

Question number	Answer	Additional guidance	Mark
7(b)(i)	An answer that includes the following point: • (cardiac) diastole (1)		(1)

Question number	Answer	Additional guidance	Mark
7(b)(ii)	• 100	accept 1.67 beats per second accept range 100 - 125	(1)

Question number	Answer	Additional guidance	Mark
7(b)(iii)	An answer that includes three of the following points: Similarity • both traces have the same {PQRST/ described} wave (1) • R wave of similar height (1) Differences • normal ecg shows a lower heart rate (1) • in the patient trace the gap between T & P is shorter (1)	both show clear PQRST wave accept converse accept converse	(3)

Question number	Answer	Additional guidance	Mark
7(c)	An answer that includes four of the following points: • {identification / isolation} of (corrected) AAT gene (1) • description of one enzyme used to insert gene (1) • adenoviruses can enter host cell (1) • and combine their own genetic material with that of the cell (1) • therefore a functional AAT protein can be produced (1)	E.g. cut the adenovirus DNA using the same restriction endonuclease / insert the gene into the adenovirus DNA using DNA ligase adenovirus acts as a vector	(4)

Question number	Answer	Additional guidance	Mark
8(a)	An answer that includes three of the following points: • toxicant absorbed into the blood (in the gut) (1) • crosses blood brain barrier (1) • {prevents production/less secretion} of dopamine (1) • inhibits uptake of dopamine by motor control centres of the brain (1)	accept killing dopamine producing cells	(3)

Question number	Answer	Additional guidance	Mark
8(b)	An answer that includes two of the following points: • use microarray (to identify affected gene(in sample) (1) • technique detail (1) • use of bioinformatics / algorithms (to analyse the data from the microarray (1)	E.g. cut using endonuclease enzymes / use of fluorescent dyes any reasonable technique PCR, amplification accept reference to use of computer database	(2)

Question number	Answer	Additional guidance	Mark
8(c)	An explanation that includes three of the following points: • process to {sequence genes/ DNA fingerprinting/DNA profiling} (1) • compare sequences to show similarities between (species/ humans and zebrafish) (1) • show product of the genes have (same/similar/related) functions (1)	accept reference to amino acid sequence of protein Accept use of PCR to make multiple copies comparing bands (only in context PCR)	(3)

Question number	Answer	Additional guidance	Mark
8(d)	An answer that includes the following points: {target/ bind to} transcription factor • they could change the shape of the transcription factor (1) • they could prevent binding of transcription factor to DNA (1) • RNA polymerase unable to bind (1)	accept damage to transcription factor accept prevent binding to receptors / promoters accept inactivates the transcription factor	Choose an item. (3)

Question number	Answer	Additional guidance	Mark
8(e)	An answer that includes the following points: • (breaks in the strands due to) phosphodiester bonds being broken (1) • (strands are separated due to) hydrogen bonds being broken (1) • causes mutation (1)		Choose an item. (3)

Question number	Answer	Additional guidance	Mark
8(f)	A description that includes four of the following points: • use of {living / viable cells}(1) • reduced NAD produced during aerobic respiration(1) • use the same concentrations of drugs (1) • record how long it takes the solution to turn purple / accept reference to use of colorimeter(1) • the longer it takes to turn purple the more toxic the drug (1)	accept converse	(4)

Question number	Answer	Additional guidance	Mark
8(g)	An answer that includes two of the following points: • individuals have different genetic background / make up (1) • because response to toxicity is individual(1) • because embryonic stem cells do not have to be used so no ethical issue (1)	assays takes into account individual epigenetic influences no destruction of embryo so no ethical issues	(2)