



Mark Scheme (Results)

January 2025

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

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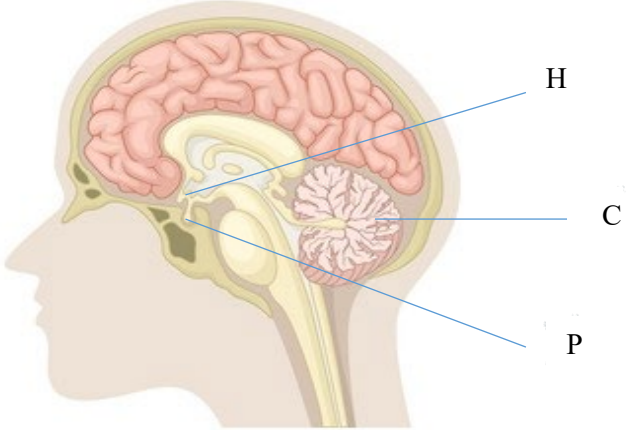
General Marking Guidance

- 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	Mark
1(a)(i)	An answer that includes the following points: • correct peptide bond (1) • water molecule (1)	$\begin{array}{c} \text{H} \\ \\ -\text{N} - \text{C}- \\ \\ \text{O} \end{array}$ ACCEPT the H going down from N ACCEPT symbol or drawn e.g. H-O-H	(2)

Question number	Answer	Additional guidance	Mark
1(a)(ii)	A is the correct answer B is not correct as decarboxylation does not join two amino acids together it removes a carboxyl group C is not correct as hydrolysis does not join two amino acids together it is where water is used to break down chemical bonds D is not correct as phosphorylation does not join two amino acids together it attaches a phosphate group to a molecule		(1)

Question number	Answer	Additional guidance	
1(b)	A description that includes three of the following points: • {transported to / broken down in} the liver (1) • amine<u>g</u>roup removed / deamination occurs (1) • (amine group) converted to urea (1) • in the ornithine cycle (1)	IGNORE reference to ammonia / ammonium ions IGNORE amino group ACCEPT converted to {ketone bodies keto acid / glucose / pyruvate} ACCEPT a correct description of the ornithine cycle	(3)

Question number	Answer	Additional guidance	
2(a)	Choose an item. • correct label positioning for pituitary gland (1) • correct label positioning for cerebellum (1) • correct label positioning for hypothalamus (1)	 shutterstock.com · 464034644 ACCEPT names in full	(3)

Question number	Answer	Additional guidance	
2(b)	An answer that includes the following points: • correct function for hypothalamus (1) • correct function of medulla oblongata (1) • correct function of pituitary gland (1)	Take first answer in list ACCEPT {production / release} of {hormones / correct named hormone} / control homeostasis / (regulates) osmoregulation / body temperature / metabolic coordination ACCEPT control of heart rate / breathing rate / blood pressure / vomiting ACCEPT regulation of growth / metabolism / osmoregulation {release or storage} of correct named hormone	(3)

Question number	Answer	Additional guidance	Mark
3(a)(i)	A is the correct answer B is not the correct answer as a wider afferent arteriole does not increase water movement by osmosis into the Bowman's capsule C is not the correct answer as a wider afferent arteriole does not reduce the risk of capillary damage due to high pressure D is not the correct answer as a wider afferent arteriole does not reduce water reabsorption from the proximal tubule		(1)

Question number	Answer	Additional guidance	Mark
3(a)(ii)	C is the correct answer A is not the correct answer 6×24 does not equal 124 dm^3 B is not the correct answer as 6000×24 does not equal 144 cm^3 and it has not been converted to dm^3 D is not the correct answer as 6000×24 does not equal 1440 cm^3		(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	A calculation showing the following steps: • calculation of daily urine production (1) • answer given in standard form (1)	$1.5 \times 60 \times 24$ OR 2160 2.16×10^3 Accept 2.160×10^3 / 2.2×10^3 correct answer gains full marks	(2)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer that includes the following points: • as ADH (concentration) increases the urine concentration increases (1) • as ADH (concentration) increases the rate of urine production decreases (1)	ACCEPT 'it' for ADH concentration IGNORE higher urine concentration with lower urine production rate ACCEPT converse ACCEPT positive correlation between ADH concentration and urine concentration ACCEPT converse ACCEPT negative correlation between ADH concentration and rate of urine production	(2)

Question number	Answer	Additional guidance	Mark
3(c)	An explanation that includes three of the following points: • increases movement (of water) (1) • due to increased permeability of collecting duct (1) • (because ADH causes) {aquaporins / pores/ channels} to be inserted into {membrane / collecting duct} (1) • water moves {down water potential gradient /by osmosis} (1)	ACCEPT increases the reabsorption of water ACCEPT (ADH causes) increase in aquaporins in {membrane / collecting duct} ACCEPT high to low water potential	(3)

Question number	Answer	Additional guidance	Mark
4(b)	A calculation showing the following steps: • calculation of gradient at steepest part of upward curve (1) • answer given to two significant figures with correct units (1)	ECF for mp 2 providing dy/dx calculated and given to 2 significant figures $(9 \div 0.5)$ or 18. = 18 a.u. millisecond⁻¹ correct answer scores full marks accept range 17.0- 20.0 a.u. millisecond⁻¹	(2)

Question number	Answer	Additional guidance	Mark
4(c)	A is the correct answer B is not the correct answer as 0.3:1 is not the correct ratio C is not the correct answer as 0.083:1 is not the correct ratio D is not the correct answer as 1:38.75 is not the correct ratio		(1)

Question number	Answer	Additional guidance	Mark
4(d)(i)	An answer that includes these two the points - increased / faster / speed up (nerve impulse) (1) - ion channels open (and close) more quickly / (sodium) ions diffuse more quickly / (sodium) ions have more kinetic energy (1)	ACCEPT Na⁺ for sodium ions ignore particles ACCEPT increased rate of transmissions IGNORE enzyme activity ACCEPT ions move quicker / more influx of ions IGNORE increased permeability to ions for 2 marks accept decreased speed due to denaturation of ion channels ONLY	(2)

Question number	Answer	Additional guidance	Mark
4(d)(ii)	A description that includes two of the following points: - the larger the diameter the higher the speed (of impulse) (1) - myelination increases speed (of impulse) / absence of myelin decreases speed (of impulse) (1) - myelination has greater effect than axon diameter (on speed of impulse) (1)	IGNORE if answers comparing neurones A/B/C/D without reference to myelination / axon diameter ACCEPT converse	(2)

Question number	Answer	Additional guidance	Mark
5(a)	maintaining the body in a state of dynamic equilibrium (1)	ACCEPT maintenance of a constant internal environment ACCEPT {control / regulation} of a constant internal environment IGNORE example of homeostasis described	(1)

Question number	Answer	Additional guidance	Mark
5(b)	An answer that includes the following points: Similarities • they both decrease (over the duration of exercise) (1) • they both show the faster decrease over the first 50 minutes / slower decrease after 50 minutes (1) Differences • the concentration of insulin decreases {more / faster} in the untrained individual / after 50 mins insulin concentration decreases in trained individuals slower than untrained individuals / (apart from 0) trained individuals always have {higher / less negative} insulin concentration than untrained individuals (1)	Max 2 similarities IGNORE reference to time for mp1 IGNORE levels off after 50 mins ACCEPT gradient {described / calculated} for comparison trained / untrained ACCEPT converse	(3)

Question number	Answer	Additional guidance	Mark
5(c)(i)	A description that includes three of the following points: • {extract / isolate / cut} the {two genes / genes for both polypeptides} using {restriction enzyme / endonuclease} (1) • cut plasmid with same {restriction enzyme / endonuclease} (1) • {splice / join/insert} {sticky ends / plasmid and gene(s)} together with (DNA) ligase (1) • plasmid inserted into bacteria (1)	IGNORE restricting enzyme IGNORE restricting enzyme IGNORE gene being inserted into bacterium	(3)

Question number	Answer	Additional guidance	Mark
5(c)(ii)	An answer that includes two of the following points: • not limited by the slaughter of animals (1) • {large / more} quantities can be made / cheaper (1) • no {ethical / religious} (issues linked to the {use of / killing} animals) (1) • more effective at treating diabetes / reduced {risk of rejection / allergic reaction/ immune response} (1) • no risk of transferring infections (between other animals to humans) (1)	ACCEPT animals not lost from food chain ACCEPT produced faster / produce many IGNORE cheap unqualified / bacteria produced faster ACCEPT animal insulin may be different so less effective	(2)

Question number	Answer	Additional guidance	Mark
5(d)(i)	An answer that includes one of the following points: - no {change / increase} (in the number of cells) (1) - cells will not {grow / divide (by mitosis) without insulin (1)		(1)

Question number	Answer	Additional guidance	Mark
5(d)(ii)	A description that includes two of the following points: - contained repeat (each concentration / experiment) / {mean(s) / average(s)} calculated (1) (so that) standard {deviation(s) / error(s)} can be calculated (1)	ACCEPT replicates ACCEPT SDs calculated	(2)

Question number	Answer	Additional guidance	Mark
5(d)(iii)	Choose an item • {size / overlap} of error bars compared (1) • Overlapping error bars shows no significant difference / non overlapping error bars show significant difference (1)	IGNORE reliability / validity / repeatability	(1)

Question number	Answer	Additional guidance	Mark
6(a)	B is the correct answer A is not the correct answer as auxin would not increase the likelihood that a neuron will produce a nerve impulse at the post synaptic membrane as it is a plant hormone C is not the correct answer as gibberellin would not increase the likelihood that a neuron will produce a nerve impulse at the post synaptic membrane as it is a plant hormone D is not the correct answer as statin would not increase the likelihood that a neuron will produce a nerve impulse at the post synaptic membrane as it is a drug used to reduce cholesterol		(1)

Question number	Answer	Additional guidance	Mark
6(b)(i)	An answer that includes three of the following points: • low oxygen concentration decreases cell survival (1) • as lidocaine concentration increases {cell survival / percentage} increases (1) • error bars do not overlap so significantly different (1)	ACCEPT converse argument / description ACCEPT with lidocaine cell survival does not reach {100% / as high / doesn't increase as much} (as control does) / control has the highest survival ACCEPT lidocaine in 0.01 has almost same effect as oxygen rich cells ACCEPT positive correlation ACCEPT error bars do overlap for control and 0.01 so results not significantly different	(3)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	B is the correct answer A is not the correct answer as it is not a hormone that initiates differentiation C is not the correct answer as it is not how a heart beat is initiated in the atrio-ventricular node D is not the correct answer as it is not how muscles work in pairs		(1)

Question number	Answer	Additional guidance	Mark
6(b)(iii)	An answer that includes two of the following points: • {prevents / reduces / inhibits} {(electrical)impulses / action potentials / depolarisation} (spreading over heart muscle) (1) • lidocaine reduces {rate of contraction / (heart) muscle cell contraction} (1) • (therefore) reducing the need for oxygen (for respiration) / reducing need for ATP (1)	ACCEPT prevent diffusion of sodium ions / prevents influx of sodium ions ACCEPT low(er) {heart rate / stroke volume} ACCEPT resulting in reduced conversion of pyruvate into lactate / {no / reduced} lactic acid	(2)

Question Number	Answer	
*6(c) 1 2 3+4 5	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. 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. Consideration of heart rate / bpm and exercise (Graph 1). • At start of exercise HR increases in both athletes and non athletes • the increase in HR is steeper in non athletes than athletes • peak HR higher in non athletes than athletes • HR levels off in both athletes and non athletes during exercise • at end of exercise HR reduces faster in athletes than non-athletes • at end of exercise HR returns to normal faster in athletes and non athletes Consideration of weekly physical activity and mortality risk (Graph 2). • Person with CVD and no physical activity per week risk of death is greatest • risk of CVD reduces with increase in physical activity per week for both person with or without CVD • if no CVD there is a lower risk of dying than if you have CVD • risk of death decreases more in person with CVD than without as duration of exercise increases. • If person with CVD increases duration of exercise the risk of death almost meets the same level as a person without CVD Consideration and explanation of health benefits to improve the outcomes for patients with CVD Benefits Heart / Blood circulation • exercise leads to a stronger heart as {cardiac muscle increases / increase in size of heart chambers} • Leading to more oxygenation of cells / heart pumps more efficiently/higher stroke volume /higher cardiac output • exercise can lead to reduce blood pressure due to {greater flexibility of blood vessels /vasodilation / • exercise improves {lung function/ lung capacity / lungs} / as more oxygen taken up in the alveoli • exercise increases volume of blood circulating as blood vessels {less stiff / more flexible} • exercise stimulates the release of Nitric Oxide leading to vasodilation of blood vessels CVD • reduced {blood pressure / heart rate / cholesterol} linked to reduced risk of atheroma / plaques • reduced risk of {blood clots / embolism} leading to {heart attack / CVD / stroke}	(6)

6 7	- athletes have a reduced risk of atherosclerosis - exercise can reduce plaques leading to improved blood circulation Hormones / Brain / Metabolism - exercise reduce levels of stress hormones eg cortisol, adrenaline which positively enhances body function / metabolism - exercise causes release of ‘feel good’ hormones which reduces nervous transmission within the brain / reduces stress - exercise leads to cells becoming more responsive to insulin so cells {absorb / metabolise / respire) more glucose / increase weight loss so less strain on heart - exercise reduce inflammation throughout the body / reduces CRP levels - exercise leads to enhanced mitochondrial function leading to greater {respiration / heart contraction} - exercise leads to greater stores of {myoglobin / oxygen} in muscles so more aerobic respiration Conclusion / summary / comment on methodology No detail about age / gender / lifestyle / numbers involved However other factors may also contribute to death by CVD - lifestyle, diet, genetics, smoking, drinking, obesity	
	Additional guidance	
Level 0	0	No awardable content
Level 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. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and / or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.
Level 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. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.

Question number	Answer	Additional guidance	Mark
7(a)(i)	An answer electron (microscope) (1)	REJECT electric, electrical, E, electronic ACCEPT EM or EM REJECT SEM \ scanning electron microscope	(1)

Question number	Answer	Additional guidance	Mark
7(a)(ii)	A calculation showing the following steps: - calculation of length in micrometres of A-B (1) - answer given to three significant figures (1)	No ecf 30 000 μm Accept 29000-31000 $(30\,000 \div 23\,500) = 1.28$ $= 1.28\,(\mu\text{m})$ Accept 1.23 – 1.32 μm Correct answer gains full marks	(2)

Question number	Answer	Additional guidance	Mark
7(b)(i)	B is the correct answer A is not the correct answer as chemiosmosis is not where hydrogen ions are pumped from the matrix to the intermembrane space through ATP synthase C is not the correct answer as chemiosmosis is not where hydrogen ions diffuse from the intermembrane space to the stroma through ATP synthase D is not the correct answer as chemiosmosis is not where hydrogen ions jump from the inner membrane to the outer membrane and out through ATP synthase		(1)

Question number	Answer	Additional guidance	Mark
7(b)(ii)	B is the correct answer A is not the correct answer as Krebs cycle activity decreases C is not the correct answer as Krebs cycle activity and oxygen consumption decrease D is not the correct answer as oxygen consumption decreases		(1)

Question number	Answer	Additional guidance	Mark
7(b)(iii)	A is the correct answer B is not the correct answer as oxidised NADP is not used in the removal of a C atom from pyruvate in the link reaction C is is not the correct answer as reduced NAD is not used in the removal of a C atom from pyruvate in the link reaction D is not the correct answer as reduced NADP is not used in the removal of a C atom from pyruvate in the link reaction		(1)

Question number	Answer	Additional guidance	Mark
7(c)	• carbon dioxide / CO₂ (1) • ATP (1) • reduced NAD / NADH (1) • reduced FAD / FADH₍₂₎ (1) • oxaloacetate / OAA (1)	mark first 3 Any three equals two marks two equals one mark IGNORE incorrect formula IGNORE numbers e.g. 6ATP	(2)

Question number	Answer	Additional guidance	Mark
7(d)	A description that includes four of the following points: - as the {number of days / times} increases, the number of mitochondria increases (1) - as the {number of days / times} increases, the concentration of ATP increases (1) - due to increased demand for ATP in {cell activity / cell processes} (1) - ATP {production / use} does not increase in the same way as the number of mitochondria (1) - comment on {error bars / standard deviation / lack of data after 10 divisions / data missing} (1)	ACCEPT positive correlation between time and number of mitochondria Must be after cell division NOT as the cell divides ACCEPT positive correlation e.g. other described processes in {cell differentiation / neurones} that requires energy from ATP e.g. protein synthesis / production of sodium ion channels / neurotransmitters / receptors / elongation of cell / establishing resting potential ACCEPT smaller (%) increase for ATP increase / converse e.g. error bars for number of mitochondria do not overlap so results are significantly different Error bars for concentration of ATP overlap {1-3 days / 5-7 days / 7-10 days} so results not significantly different ACCEPT converse for significant difference - eg mitochondria 7-10 days IGNORE sample size and other comments on methodology	(4)

Question number	Answer	Additional guidance	Mark
8(a)	An answer that includes one of the following points: • correct reason for benefit of optimal hydration (1)	there will be other answers e.g.to regulate body temperature keep joints lubricated (1) prevent infections / reduce inflammation (1) deliver nutrients to cells, (1) keep cells / tissues/organs functioning properly (1) enable {metabolic/ enzyme / chemical} reactions to occur (1) maintain structure of cells maintain salt concentration / water potential / allow osmosis to occur decreases ageing IGNORE prevent dehydration / digestion unless linked to hydrolysis	(1)

Question number	Answer	Additional guidance	Mark
8(b)	An explanation that includes three of the following points: • caffeine (and its metabolites) absorbed into the blood (1) • (carried to brain) where it crosses the blood brain barrier (1) • where it binds to (specific) receptors (on neurones) (1) • caffeine causes {sodium ion channels open /allows neurones to continue {transmission / depolarisation} / more action potentials / release of neurotransmitters} (1)	ACCEPT blocks adenosine receptors (in synapse) ACCEPT caffeine enhances {the effects of dopamine / increases {cortisol/ dopamine} secretion}	(3)

Question number	Answer	Additional guidance	Mark
8(c)	An answer that includes the following points: • correct suitable reason (1) • correct relevant explanation of reason (1)	• larger surface area • larger (muscle) mass • more cells • males have a greater energy requirement • males have less fat • males have higher metabolic rate • so more water lost by (evaporation) • more heat released so more sweating to maintain body temperature • more water needed in {enzymic reactions / respiration} • as muscles store less water than fat • women store more fat than men so can have a bigger store of water in fat than men there may be other acceptable responses	(2)

Question number	Answer	Additional guidance	Mark
8(d)	An explanation that includes five of the following points: • by homeostasis / osmoregulation (1) • osmoreceptors {in the brain / hypothalamus} detect ↓ (changes in) water potential (of blood) (1) • impulses sent to the pituitary gland (1) • releasing {more / less} ADH (1) • causing the {DCT / collecting duct} to reabsorb {more / less} water/ sodium ions (1)	ACCEPT reference to process of sodium concentration being too high or too low IGNORE concentration ACCEPT releasing more / less aldosterone ACCEPT causing {DCT / collecting duct} to become {more / less} permeable / {more / fewer} aquaporins in {DCT / collecting duct}	(5)

Question number	Answer	Additional guidance	Mark
8(e)	An explanation that includes the following points: • water moves out (from the cell) by osmosis (1) • because concentration of solutes is higher {outside the cell / in blood / in tissue fluid} (than in the cell) / (1)	ACCEPT higher water potential inside cell / lower water potential {outside the cell / in blood / in tissue fluid} accept water moves down {water potential / water concentration} gradient	(2)

Question number	Answer	Additional guidance	Mark
8(f)	An answer that includes two of the following points: • {increased / high} levels of nitrate in the blood (1) • results in relaxation of smooth muscle (of blood vessels) (1) • leading to {vasodilation / widening of lumen} (1)	ACCEPT {nitrite / NO / nitrous oxide / nitric oxide / metabolite of nitrate} for nitrate ACCEPT nitrate transported to heart ACCEPT stimulation of SAN to give more depolarisation ACCEPT leading to increased {stroke volume / cardiac output / heart rate}	(2)

Question number	Answer	Additional guidance	Mark
8(g)	A description that includes three of the following points: - compare {groups / individuals} consuming [energy drinks v non energy drinks/ before and after drinking energy drinks} (1) - perform ECG (1) {analyse / compare} ECG for (irregular) heart rhythm (1)	ACCEPT energy drink drinker and non-energy drink drinker ACCEPT descriptions e.g. interval between {same / named} peak changes ACCEPT compare to see the difference in ECG traces	(3)

Question number	Answer	Additional guidance	Mark
8(h)	An answer that includes the one of the following points: - correct reason (1) - explanation of reason (1)	Reason and explanation MUST be linked. e.g. an allergy to milk protein / lactose intolerance / cannot breakdown {lactose/ milk sugar} e.g. {inability to produce / deficiency} in enzyme lactase / {gene / allele} coding for lactase is missing /immune response to milk protein	(2)

