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Mark Scheme (Results)

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Pearson Edexcel International Advanced Level In Biology Pearson Edexcel (WBI05) Paper 01 Energy, Exercise and Coordination

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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.

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Question Number	Answer	Additional Guidance	Mark
1(a)	1. SAN initiates wave of depolarisation 2. idea that electrical impulses spreads across the atria/causes atria to contract ; 3. (wave of depolarisation) is delayed by AVN ; 4. wave of depolarisation spreads across ventricles/causes ventricles to contract ; 5. frequency at which heart muscle fibres contract is regulated by the frequency of electrical impulses arriving at the SAN / speed at which electrical impulses spread across the heart determines the length of the cardiac cycle} ;	**ALLOW** impulse	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(b)	1. an ECG is a recording of the electrical activity of the heart ; 2. decreased frequency of ECG peaks suggest a decrease in heart rate ; 3. change in/iregular distance between named parts of ECG trace suggest a change in the cardiac cycle ;	**ALLOW** converse e.g. longer time between Q and T suggests heart takes longer to recover between heart beats	**(2)**

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Question Number	Answer	Additional Guidance	Mark
1(c)	1. the FGF-I gene is removed from (the DNA) of a human ; 2. gene/plasmid is cut using a restriction enzyme/endonuclease ; 3. gene and plasmid are joined using (DNA) ligase ; 4. plasmid with the FGF-1 gene is inserted into bacteria ; 5. credit additional information on method of inserting plasmid into the bacteria ;	**ALLOW** gene is synthesised based on known DNA sequence **ALLOW** other appropriate microorganisms e.g. yeast	**(4)**

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Question Number	Answer	Additional Guidance	Mark
2(a)(i)	**D retina** A is not correct. The lens focusses light on the retina at the back of the eye. B is not correct. The optic nerve transmits impulses from the retina to the brain. C is not correct. The pupil is an opening in the iris that allows light into the eye.		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	**A membrane bound organelles in the outer segment** B is not correct. The membrane bound vesicles containing the photoreceptor is in the outer segment of the cell. C is not correct. The photoreceptor is located in membrane bound vesicles. D is not correct. The photoreceptor is located in membrane bound vesicles in the outer segment.		**(1)**

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Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	**D rhodopsin** A is not correct. Auxin is a growth factor found in plant cells. B is not correct. Cytochrome is a pigment found in the electron transport chain C is not correct. Phytochromes are pigments found in plant cells.		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. the more intense the light flash the more (hyper)polarised the cell membrane becomes / the greater the intensity the more negative the membrane potential becomes ; 2. the more intense the flash the longer the cell remains (hyper)polarised / the greater the intensity the longer the membrane potential stay negative ; 3. there is a maximum (hyper)polarisation so (very) high light intensity has no further effect on the size of the membrane potential / the more intense the light the more rapidly the cells are hyperpolarised ;	**ALLOW** membrane potential decreased more	**(2)**

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Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. the greater the {hyperpolarisation/generator potential} the {less / no} {glutamate / neurotransmitter} is released (by the rod cell) ; 2. the greater the number of action potentials generated in the {bipolar cell / sensory neurone} ; 3. increased frequency of action potentials is interpreted as more intense light ; 4. (by) the visual cortex/occipital lobe ;	**ALLOW** optic nerve	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	**B homeostasis** A is not correct. Habituation is a learned response. C is not correct. Photoperiodism is a response that is controlled by a light cycle. D is not correct. Respiration is a metabolic process.		**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	**A Q** B is not correct. R is the cerebrum. C is not correct. S is the cerebellum		

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Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. inverse relationship (between temperature and oxygen consumption) for temperatures up to {26 °C / 30°C} ; 2. no change in oxygen consumption for temperatures above {26 °C / 30° C} ; 3. credit a quantitative statement to support mark point 1 ;	e.g. calculation of the gradient of the line between 5 and 26 °C ;	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	1. as temperature decreases mouse {loses heat faster / needs to produce more heat} ; 2. (as part of homeostatic response) (aerobic) respiration/metabolism increases ; 3. to provide ATP for increased {muscle contractions / shivering} ; 4. respiration produces heat (to help maintain body temperature) ;	Converse for all mps NOT energy unqualified	**(3)**

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Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	1. a larger animal has a smaller surface area to volume ratio ; 2. the smaller the surface area to volume ratio the slower the rate of heat loss ; 3. idea that the graph will have a less steep gradient/ will level off at a lower oxygen consumption rate ;	**ALLOW** 'not as easily' **ALLOW** idea that less affected by change in (environmental) temperature / curve to the left of this data because lower metabolic rate	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	**C Yes No** A is not correct because L is a tendon and is flexible B is not correct because L is a tendon and is flexible but not elastic D is not correct because L is a tendon and is not elastic		**(1)**

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Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	**D N is a sensory neurone M and P are an antagonistic pair of muscles** A is not correct because N is a sensory neurone and M and P are an antagonistic pair of muscles B is not correct because N is a sensory neurone C is not correct because M and P are an antagonistic pair of muscles		**(1)**

Question Number	Answer	Additional Guidance	Mark
***4(b)**	QWC emphasis on a logical sequence 1. (voltage gated) sodium (ion) channels open ; 2. allowing sodium ions to diffuse/move into the axon / neuron ; 3. the {axon/neuron} becomes {depolarised / positively charged inside} ; 4. (voltage-gated) sodium (ion) channels close ; 5. (voltage gated) potassium (ion) channels open ; 6. potassium ions {diffuse/move} out of the axon, repolarising the membrane ; 7. the membrane becomes hyperpolarised, closing (voltage gated) potassium (ion) channels ; 8. potassium ions {diffuse/move} back into the axon through		

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Question Number	Answer	Additional Guidance	Mark
4(c)(i)	1. no (significant) difference in conduction speed from spinal cord to biceps ; 2. conduction speed from brain to biceps is {slower/decreased} in people with multiple sclerosis ; 3. credit use of manipulated data to support mark points 1 or 2 ;	**ALLOW** ref to time IF comparable **ALLOW** idea that speed in PNS not affected **ALLOW** idea that speed in CNS is decreased	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	1. conduction speed is faster in myelinated neurones ; 2. because (in myelinated neurones) {action potentials jump between gaps in the myelin sheath / of saltatory conduction} ; 3. when myelin is removed action potentials have to move along the whole axon (slowing down the speed of conduction) ;	**ALLOW** converse argument **ALLOW** impulse	**(3)**

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Question Number	Answer	Additional Guidance	Mark
5(a)(i)	**B phytochrome** A is not correct. Auxin is a plant growth factor. C is not correct. Retinal is a part of the photoreceptor found in mammals D is not correct. Rhodopsin is the photoreceptor found in mammals.		**(1)**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	**A long day length at temperatures of 10 °C or above** B is not correct because very little germination occurred at °C C is not correct because significant germination only occurred with 22 hours of daylight D is not correct because significant germination only occurred with 22 hours of daylight at temperatures of 10 °C or above		**(1)**

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Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. 43 – 18 = 25 ; 2. (25 ÷ 18) x 100 = 139 (%)	 **ALLOW 138.9, 140, 139** Correct answer with no working gains both marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. as the ratio of red to far-red light decreases {gene expression / mRNA synthesis} (for all three genes) increases ; 2. the effect on YUC3 is greater (than on the other two genes) ; 3. appropriate manipulation of data to support MP1 or 2 ;	 **Eg.increasing red to far-red ratio from 1.4 :1 to 0.2:1 increases concentration of mRNA au in YUC1by 1.8/ YUC2 by 1.6/YUC3 by 4.5**	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	1. reference to phytochromes ; 2. conversion of phytochrome red to far-red or vice versa ; 3. as ratio of {red to far-red decreases / far-red to red increases} more mRNA synthesis ; 4. (more mRNA synthesis results in) more auxin (IAA) ;	 **ALLOW** protein in place of auxin	

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Question Number	Answer	Additional Guidance	Mark
6(a)	1. reference to {reduced NAD / reduced FAD / reduced coenzymes} ; 2. transport {hydrogen atoms / (protons and) electrons} to the electron transport chain ; 3. electrons move along electron transport chain (in series of redox reactions) ; 4. energy (released) is used to pump {protons / H^+ / hydrogen ions} into the inter-membrane space ; 5. protons {diffuse/move} (down electrochemical gradient) through {ATP synthase / ATPase / stalked particle} (back into the matrix) ; 6. (catalysing the) formation of ATP from ADP and Pi ;	**ALLOW** electrons move along cytochromes **ALLOW** reference to chemiosmosis **ALLOW** phosphorylating ADP or equation ADP + Pi -> ATP IGNORE producing ATP	**(5)**

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Question Number	Answer	Additional Guidance	Mark
6(b)(i)	1. oxygen concentration at 50% glucose concentration = 17 (a.u.); 2. change in concentration of oxygen = 120 – 17 = 103 (a.u.) ; 3. (103 ÷ 120) x 100 = 85.8 (%) ;	**ALLOW** ecf from value used in 1 in mp2 and 3 **ALLOW** 86 (%) / 85.8 (%) Correct answer with no working gains all 3 marks	**(3)**

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	1. idea that the pH decreases as distance (from the capillary) increases ; 2. (aerobic) respiration produces carbon dioxide (which reduces the pH) ; 3. (at low oxygen concentrations) tumour cells respire anaerobically ; 4. {lactic acid / lactate} is produced (from pyruvate) ;	**ALLOW** negative correlation	**(3)**

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Question Number	Answer	Additional Guidance	Mark
7(a)	1. used to phosphorylate ADP / produce ATP ; 2. (climbing involves) muscles / muscle contraction ; 3. ATP used in muscles to move actin and myosin filaments past each other ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. reference to **evolution** ; 2. (random) mutations create variation ; 3. selection pressure acts on {population / phenotypes / alleles} ; 4. individuals with advantageous alleles survive to reproduce / leads to an increase in advantageous allele frequency ;	**ALLOW** genes **ALLOW** natural selection	**(3)**

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Question Number	Answer	Additional Guidance	Mark
7(c)	1. (blockage of the coronary arteries) reduces blood supply to heart cells / fibres / tissue / muscle ; 2. reducing supply of {oxygen / nutrients} to muscle fibres heart cells / tissue / muscle ; 3. muscle {respires anaerobically / becomes anoxic} ; 4. muscle {fibres / cells} die ;	**ALLOW** can't contract	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(d)	1. {population / group} of *Australopithecus* with similar characteristics ; 2. able to mate {with each other / interbreed} to produce fertile offspring ; 3. but not able to produce fertile offspring with other species of *Australopithecus* ;	**ALLOW a generic answer without ref to** *Australopithecus*	**(2)**

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Question Number	Answer	Additional Guidance	Mark
7(e)	1. stronger cardiac muscle ; 2. ventricles have thicker walls ; 3. larger {stroke volume / describe} ; 4. allows {increased cardiac output / described} ; 5. without the need for an increase in heart rate ;	**ALLOW more muscle**	**(4)**

Question Number	Answer	Additional Guidance	Mark
***7(f)**	QWC Emphasis on clarity of expression 1. idea that mutations occur in the gene for an enzyme/protein required to make vitamin C ; 2. primary structure determined by amino acid sequence ; 3. {folding of protein / secondary / tertiary structure} determined by primary structure ; 4. mutations change {primary structure / amino acid (sequence) / introduction of a stop codon / secondary structure / tertiary structure/shape} ; 5. so {active site no longer fits molecule used to make vitamin C / enzyme to make Vitamin C not produced} ; 6. unable to convert a precursor molecule into vitamin C ;		

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Question Number	Answer	Additional Guidance	Mark
7(g)	1. oxygen concentration in water is low ; 2. to maintain an oxygen concentration gradient ; 3. (water needs to be replaced as) oxygen diffuses through the fishes gill ;	ALLOW so oxygen can {move/diffuse } {across gill / into blood}	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(h)	1. act i(n synapses) in the brain ; 2. via a suggested mechanism ;	e.g. bind to postsynaptic receptors / inhibit re-uptake of neurotransmitters involved in pleasure response	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(i)	1. rich blood supply / eq (to supply nutrients) ; 2. {many / more} mitochondria (to provide ATP) ; 3. {high concentration / more} of myoglobin (to store oxygen in the muscle fibres) ;	ALLOW more blood vessels NOT more red blood cells	

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Question Number	Answer	Additional Guidance	Mark
7(j)	1. {inner membrane more folded / more cristae / has a greater surface area} ; 2. so more ETC/more carrier proteins ; 3. and more stalked particles ; 4. producing more ATP / producing ATP faster ;		**(3)**