Pearson Edexcel

Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advanced Level
in Biology (WBI05)
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.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. percentage increase in volume of air breathed in per minute increases with increasing CO_2 concentration / eq ; 2. steepest increase is between 6 and 8 % CO_2 ; 3. levels off after 10 % / eq ;	**IGNORE** simple descriptions **ALLOW** ventilation rate **IGNORE** breathing rate **ALLOW** a pair of value between 4 and 10 that include 6 to 8%	**(3)**

Question Number	Answer	Additional Guidance	Mark
1(b)	1. the concentration of carbon dioxide in the { alveoli / air sacs } is higher / eq ; 2. the concentration of carbon dioxide in the blood is higher / pH of blood is lower / eq ; 3. detected by **chemoreceptors** in {medulla / carotid artery / aorta} ; 4. reference to {**respiratory centre** / **ventilation centre** / **control centre**} ; 5. sending nerve impulses to {diaphragm / intercostal muscles } ;	**ALLOW** converse arguments for decrease in carbon dioxide concentration for MP1, 2 and 5 **IGNORE** reference to stretch receptors **ALLOW** in carotid bodies **IGNORE** receptors **IGNORE** in blood vessels **ALLOW** to muscles involved with breathing	**(4)**

Question Number	Answer	Mark
2(a)(i)	**B** – phytochrome *The only correct answer is B* *A is not correct because auxin is the name given to plant hormones* *C is not correct because retinal is a component of rhodopsin* *D is not correct because rhodopsin is the light receptor in the mammalian eye*	**(1)**

Question Number	Answer	Mark
2(a)(ii)	**B** - PFR produced in response to Red light *The only correct answer is B* *A is not correct because P_{FR} is produced in response to red light and not Far red light and germination is stimulated by red light* *C is not correct because it is the PFR that stimulates germination* *D is not correct because P_R is converted to P_{FR} by red light*	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	1. P_{FR} (slowly) changes to P_R in the dark ; 2. levels of P_{Fr} become too low to stimulate germination / levels of P_R become high enough to inhibit germination; 3. idea that seeds become less viable with storage ;	**ALLOW** a high concentration of P_{FR} stimulates germination e.g. substrates used up / moulds may grow / enzyme lose activity	**(2)**

Question Number	Answer	Mark
2(b)(i)	**C** - positive phototropism *The only correct answer is C* *A is not correct because the response is to light so is a 'photo' response and not a 'geo' response* *B is not correct because the response is to light so is a 'photo' response* *D is not correct because the shoot bends towards light and is a positive response*	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. as light intensity (for both red and blue light) increases angle of curvature increases / eq ; 2. greater response to blue light / eq ;	**ALLOW** Angle of curvature is greater for blue light	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(iii)	1. temperature ; 2. light intensity ; 3. wave length or colour of light ; 4. age of seedlings / age of coleoptile; 5. species of seedling / type of seed ; 6. growth medium ; 7. humidity / soil moisture ;		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(b)(iv)	1. IAA moves away from light / there is more IAA on the darker side of the stem / eq ; 2. (H) **bonds** between **cellulose** molecules weakened / broken / eq ; 3. the cells elongate ; 4. due to {uptake of water / increase in turgor pressure / eq} ; 5. (IAA) causes coleoptiles to { bend / grow } towards the light ;	**ALLOW** auxin in place of IAA **ALLOW** cell walls elongate	**(4)**

Question Number	Answer	Mark
3(a)(i)	**C** *The only correct answer is C* *A is not correct because opsin gene is transcribed in the nucleus in part C* *B is not correct because opsin gene is transcribed in the nucleus in part C* *D is not correct because opsin gene is transcribed in the nucleus in part C*	**(1)**

Question Number	Answer	Mark
3(a)(ii)	**A** *The correct answer is A* *B is not correct because rhodopsin is concentrated in part A the outer segment* *C is not correct because rhodopsin is concentrated in part A the outer segment* *D is not correct because rhodopsin is concentrated in part A the outer segment*	**(1)**

Question Number	Answer	Mark
3(a)(iii)	**A** - decreases / hyperpolarised *The only correct answer is A* *B is not correct because the rod cell membrane is hyperpolarised* *C is not correct because rod cell membrane becomes less permeable to sodium* *D is not correct because rod cell membrane becomes less permeable to sodium*	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. ATP provides energy ; 2. synthesis of {rhodopsin / opsin / retinal / neurotransmitters } ; 3. re-joining retinal to opsin ; 4. converting trans-retinal back into cis-retinal ; 5. used { by sodium pump to / to actively } pump sodium ions ;	**ALLOW** to reform rhodopsin **IGNORE** ATP produces energy **IGNORE** reference to un-bleaching **ALLOW** to maintain the membrane potential	**(3)**

Question Number	Answer	Additional Guidance	Mark
***3(b)(ii)**	**QWC** emphasis is clarity of expression 1. reference to **chemiosmosis** ; 2. reference to **oxidative phosphorylation** ; 3. electrons and protons from { NADH / FADH / reduced NAD / reduced FAD } ; 4. energy released by electrons moving along electron transport chain ; 5. is used to pump protons (across the inner membrane) ; 6. into space between inner and outer membrane / eq ; 7. protons diffuse through ATP synthase ; 8. (ATP synthase) phosphorylates ADP to form ATP ; 9. (some) ATP produced by substrate level phosphorylation ;	**ALLOW** produced by reduced hydrogen carriers ; **ALLOW** H^+ / hydrogen ions for protons **IGNORE** hydrogen / H **ALLOW** ETC for electron transport chain **ALLOW** move down the concentration / electrochemical gradient **IGNORE** ATPase **ALLOW** ADP + Pi → ATP **ALLOW** (some) ATP produced directly (in the Krebs cycle)	**(6)**

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	soda lime ;	**ACCEPT** sodium hydroxide / potassium hydroxide / carbon dioxide absorber / NaOH / KOH	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. measure distance moved by drop oil ; 2. divide (volume / distance) by time taken ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. 2.3 and 0.5 or 1.8 ; 2. 360 (%) ;	Correct answer no working gains full marks.	**(2)**

Question Number	Answer	Additional Guidance	Mark

4(b)(ii)	1. muscles using oxygen faster than it can be delivered ; 2. anaerobic respiration is taking place ; 3. pyruvate is converted to lactate ; 4. and reduced NAD is oxidised / eq ;	**ALLOW** not enough oxygen (available to the muscle) **ALLOW** reoxidising NADH	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(c)	1. { during exercise / first 2 minutes } muscles use anaerobic respiration ; 2. oxygen consumption is increased to {repay oxygen debt / oxidise lactate / re-oxygenate myoglobin} ; 3. { during recovery / once exercise has finished } anaerobic respiration stops ; 4. oxygen uptake decreases as oxygen debt decreases / eq ;	**ALLOW** produce lactate **ALLOW** lactate has been converted back to pyruvate myoglobin has been re-oxygenated	**(4)**

Question Number	Answer	Mark

5(a)(i)	**B** - contracting | relaxing The only correct answer is B *A is not correct as these muscles are an antagonistic pair – one must contract and one relax* *C is not correct as the hamstring is the flexor muscle* *D is not correct as these muscles are an antagonistic pair – one must contract and one relax*	**(1)**

Question Number	Answer	Mark
5(a)(ii)	**D** – tendons *The only correct answer is D* *A is not correct as fast twitch fibres are muscles fibres* *B is not correct as ligaments connect bones to bones* *C is not correct as slow twitch fibres are muscles fibres*	**(1)**

Question Number	Answer	Mark
5(b)(i)	A - transcription of DNA in the nucleus *The only correct answer is A* *B is not correct because transcription takes place in the nucleus* *C is not correct because mRNA is not translated in the nucleus* *D is not correct because mRNA is translated not the gene*	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. calcium ions bind to troponin ; 2. changing the shape of troponin ; 3. { troponin / tropomyosin } move away (from actin filaments) ; 4. to allow the myosin head to bind to actin / eq ;	**ALLOW** move away from myosin binding sites **ALLOW** to allow actin myosin bridges to form	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	the greater the number of hours of physical activity the greater the frequency of osteoarthritis / eq ;	**ALLOW** positive correlation **DO NOT ACCEPT** the greater the number of hours of physical activity the greater the number of cases of osteoarthritis	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	1. (mean) BMI for each group was { similar / the same / eq } ; 2. ranges overlap / eq ;	**IGNORE** unqualified reference to no statistical difference **ALLOW** error bars, SD or SE overlap	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(c)(iii)	1. idea that procedure is less invasive ; 2. idea of less pain after operation ; 3. idea of fast { healing / recovery } ; 4. idea that there will be { less scarring / eq } ; 5. idea of reduced risk of infection ; 6. less blood loss ;	**e.g.** small incision	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(a)	1. repeat the experiment ; 2. test sound intensities above 165 a.u. ; 3. test { frequencies / intensities } at smaller intervals ;	**ALLOW** use a larger number of cuttlefish	**(2)**

Question Number	Answer	Additional Guidance	Mark
6(b)	1. use a sound frequency between 100 and 200 cycles per second ; 2. use a sound intensity between 140 and 165 a.u. ; 3. use a group of cuttlefish ; 4. idea of testing the cuttlefish with the sound at regular intervals ; 5. idea of observing the strength of the flight response ; 6. a reduced response shows habituation has occurred ;	**ACCEPT** Hz in place of cycles per second 1. and 2. **ACCEPT** a single suitable value **ALLOW** repeat with another fish e.g. measure number of flight response or strength of flight response or amount of ink produced	**(4)**

Question Number	Answer	Additional Guidance	Mark
7(a)	1. consumes a lot of food ; 2. stays below ground ; 3. star being a touch organ to locate the prey ; 4. high metabolic rate ; 5. produces heat to keep warm ; 6. reference to {**hypothalamus** / **thermoregulatory centre**} ; 7. balance heat gain and heat loss ; 8. credit method of reducing heat loss ;	**ALLOW** has a large appetite **ALLOW** uses sensitive nose to hunt **ALLOW** idea that heat generated by {shivering / muscle contraction} e.g. fur, reduced sweating, reduced vasodilation	**(5)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. papillae formed from different { cell types / tissues } ; 2. working together { with specific function(s) / as a sensory organ } ;	**ALLOW** to act as a touch organ **IGNORE** working together with similar functions	**(2)**

Question Number	Answer	Additional Guidance	Mark
7(c)	1. {pressure / vibrations} affects the membrane (of the nerve cell) ; 2. increasing the membrane permeability to sodium ions / eq ; 3. sodium ions flow into the neurone / eq ; 4. depolarising the membrane / triggering an action potential / eq ;	**IGNORE** sodium and Na **ALLOW** opens sodium ion channels **ALLOW** description of membrane depolarisation	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(d)	1. insulation ; 2. { press on / transmit pressure to } the membrane of sensory neurone ; 3. increases speed of conduction / eq ;	**ALLOW** (help) detect vibrations	**(1)**

Question Number	Answer	Additional Guidance	Mark
7(e)	1. differentiation from a stem cell / eq ; 2. signal molecules (act on the stem cell) ; 3. reference to **transcription factors** ; 4. idea of activating genes involved in synthesis of myelin ;	**IGNORE** unspecialised cell **DO NOT ACCEPT** myelin gene is activated	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(f)	1. more impulses from 11th appendage (to the cortex) ; 2. more neurotransmitter released ; 3. more synaptic connections formed ; 4. cell columns for 11th appendage are larger (than for other appendages) ; 5. pruning of unused synapses ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
7(g)	1. period of time (during early development) / eq ; 2. when (development) of the nervous system is sensitive to a stimulus / eq ; 3. { before / after } which the stimulus has no effect ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
7(h)	**QWC Emphasis is on logical sequence** 1. calcium ion channels open / calcium ions enter (neurone / knob) ; 2. vesicles { fuse / bind / eq } with presynaptic membrane ; 3. neurotransmitter released (from sensory neurones) { into synaptic cleft / by exocytosis } ; 4. reference to **diffusion** of neurotransmitter ; 5. neurotransmitter binds to receptors on post-synaptic membrane ; 6. sodium ion channels open / sodium ions enter ; 7. post-synaptic membrane is depolarised / action potential initiated / impulse initiated / wave of depolarisation initiated / post synaptic potential generated ;	**ACCEPT** Ca^{2+} / Na^{+} **ACCEPT** named neurotransmitter in MP4, MP5 and MP6 **IGNORE** into membrane **IGNORE** calcium channels **ALLOW** through membrane **ALLOW** receptors on post-synaptic neurone **IGNORE** sodium channels	**(5)**

Question Number	Answer	Additional Guidance	Mark
7(i)	1. credit recognised experiments ; 2. eye(s) deprived of light for a period of time ; 3. when opened eye does not respond to light / animal is blind ; 4. idea a control ;	e.g. effect of cataracts in new born humans or Hubel and Wiesel experiments with monkeys and kittens e.g. one eye closed one not closed, another cat	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(j)	1. geographic isolation of populations ; 2. lack of gene flow between populations ; 3. mutation(s) take place ; 4. giving (the star nosed mole) advantage in locating prey ; 5. increased frequency of advantageous alleles in the population ;	**ALLOW** example of isolation mechanism **ALLOW** better able to locate prey in soil and aquatic environments ; **ALLOW** individuals with mutated alleles survive and pass on alleles to offspring	**(3)**

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