PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 5: ENERGY FOR BIOLOGICAL PROCESSES

AEROBIC RESPIRATION

SCORE	PERCENTAGE
/62	%

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(Total for question = 3 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • citrate binds to another site on the enzyme, activating theenzyme (1) • so that the structure of the enzyme is changed (1) • so that active site binds more effectively to the substrate (1) • an increase in fatty acyl CoA molecules inhibits the substratebinding to the active site (1) • due to competitive inhibition (1)	Accept citrate and fatty acyl CoAmolecules act together to regulate the activity of the enzyme	(5)
(ii)	An explanation that makes reference to two of thefollowing: • fewer fatty acids will be made (1) • so that less fat is stored (1) • because the enzyme is being inhibited despite beingactivated by citrate (1)	Allow (less fat stored so) fatreserves used	(2)

Q2.

Question Number	Answer	Mark
(a)	1. idea that less {food /eq} required to deliver energy requirement ; 2. (so) more likely to have extra food not respired / {extra/surplus} energy ; 3. which could be laid down in body as fat / eq ;	**(2)**

Question Number	Answer	Mark
(b)	Any two from: 1. ADP 2. Pi / inorganic phosphate 3. pyruvate / pyruvic acid / lactate 4. fatty acids 5. NAD / eq 6. acetyl CoA / eq 7. water ; ;	**(2)**

Question Number	Answer	Mark
(c)	1. many {alpha / eq} glucose monomers ; 2. joined by glycosidic bonds ; 3. detail of glycosidic bonds e.g. 1-4 ; 4. reference to side branches present / 1-6 glycosidic bonds ;	**(3)**

Question Number	Answer	Mark
(d)	1. more gonadotropins ; 2. {use / muscle uptake} of (excess) fatty acids ; 3. respired to release (much) energy / increased fat metabolism ; 4. idea of reduced requirement to replenish glycogen stores ;	**(3)**

Question Number	Answer	Mark
(e)	1. (slow twitch muscles) carry out aerobic respiration / full oxidation / eq ; 2. which produces more ATP (than anaerobic) / eq ; 3. 'energy' not locked up in lactate / eq ; 4. idea that it takes longer for lactate levels to build up ;	**(2)**

Question Number	Answer	Mark
***(f)**	QWC – Spelling of technical terms (*shown in italics*) must be correct and the answer must be organised in a logical sequence) 1. Ca^{2+} leaks out of {cell / *cytoplasm* / *sarcoplasmic reticulum*} ; 2. idea of change in Ca^{2+} binding to *troponin* ; 3. causes displacement of *tropomyosin* / eq ; 4. idea of change in number of *myosin* binding sites exposed ; 5. comment on *myosin* binding to *actin* ; 6. (loss of Ca^{2+} from cell / cytoplasm) therefore force exerted by muscle is lower than expected OR (more Ca^{2+} in cytoplasm) results in less ATP so less muscle contraction ;	**(4)**

Question Number	Answer	Mark
(g)	**Process** / **Two nucleic acids involved in the process** Transcription of the ACE gene / DNA & mRNA ; Production of ACE at a ribosome / Any **two** from: mRNA, tRNA, rRNA ;	**(2)**

Question Number	Answer	Mark
(h)	1. obtain a sample of cells / extract DNA (from cells) ; 2. reference to named enzyme ; 3. idea of how to increase amount of DNA ; 4. reference to electrophoresis ; 5. details of electrophoresis ; 6. use a {DNA / gene} probe ; 7. with a base sequence complementary to that on the {variant / eq} ; 8. idea of matching with known variant profile ;	**(4)**

Question Number	Answer	Mark
(i)	B ;	**(1)**

Question Number	Answer	Mark
(j)	1. (higher metabolic rate) means more chemical reactions / eq ; 2. more {energy released / ATP used} / eq ; 3. (which) releases heat / eq ; 4. keeps divers warmer / warm for longer / able to swim without a wetsuit / eq ;	**(3)**

Question Number	Answer	Mark
(k)	1. carbon dioxide due to {deforestation / land cleaning / burning fossil fuels / correct ref to respiration / eq} ; 2. methane from {rice fields / anaerobic bacterial action / ruminant fermentation / named ruminant} ;	**(2)**

Question Number	Answer	Mark
(l)	1. 1.4 ÷ 37 = ; 2. 3.8 (%) ; Correct answer gains both 2 marks	**(2)**

Q3.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: **Similarities** • both use an electron transport chain on membranes (1) • both use ATPase driven by { H^+ gradient / chemiosmosis / eq } (1) • in both, electrons passed from one carrier to another lose energy which drives ATP production (1)	At least one similarity and one difference must be given to gain full marks. Max 2 marks if only 3 similarities provided Max 1 marks if only 2 similarities provided	**(5)**

	Differences • energy is provided by light in chloroplasts but by { glucose / pyruvate / eq } in mitochondria (1) • ATP is made by photophosphorylation in chloroplasts but by { substrate level / oxidative phosphorylation } in mitochondria (1) • in chloroplasts, electrons are provided by chlorophyll but in mitochondria, electrons are brought by reduced { NAD / FAD } (1) • in chloroplasts, (some) electrons return to chlorophyll whereas in mitochondria, electrons are accepted by oxygen (1)	Max 3 marks if only 4 differences provided Max 2 marks if only 3 differences provided Max 1 marks if only 2 differences provided	

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	• correct division of figures provided (1) • answer in correct standard form (1)	Example of calculation (250 ÷ 3.7 =) 67.568 / correct rounding of this figure 6.8×10^{-12} g Must be standard form to 2sf with units Allow full marks for correct answer with no working.	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • a nerve cell carries out a lot of active transport (1) • so it may have a greater requirement for		**(2)**

Q5.

Question Number	Answer	Mark
(i)	The only correct answer is **B** matrix **A** is incorrect because only glycolysis takes place in the cytoplasm **C** is incorrect because stroma is in chloroplasts not mitochondria **D** is incorrect because tonoplasts are in plant cells only	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • in anaerobic conditions, the pyruvate is used to reoxidise NADH so no Krebs cycle (1) • no oxygen available to act as a (terminal) electron acceptor (1) • so reduced { NAD / FAD / coenzyme} cannot be reoxidised (1) • so no (oxidised) coenzyme to bind {hydrogen ions / protons / H^+/electrons} (1)	**ACCEPT** oxygen binds to electrons **ACCEPT** NADH / $FADH_2$	(3)

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	• when one molecule of carbohydrate is respired the number of carbon dioxide molecules produced is the same as the number of molecules of oxygen used	**ACCEPT** carbon dioxide produced = oxygen used	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	• volume of both gases calculated (1) • RQ value calculated to {1 / 2} decimal places (1)	Example of calculation: oxygen volume = 4.5 × 21 + 3.75 = 98.25 carbon dioxide volume = 3 × 21 + 6 = 69 69 ÷ 98.25 = 0.70 / 0.7 / 0.702 **ACCEPT** ecf	(2)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to three of the following: Similarities • both {are hexoses / have formula of $C_6H_{12}O_6$} (1) • both contain covalent bonds (1) Differences • glucose is a hexagon and fructose is a pentagon (1) • glucose has one CH_2OH and fructose has two (1)	**ACCEPT** have 6 carbons	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • as a {respiratory substrate / energy source} for the sperm (1) • because movement (through female genital tract) requires ATP (1) • in order to reduce competition for carbohydrates with the {skin / genital tract} {bacteria / cells} (1)	**ACCEPT** provides energy **NB** ATP must be mentioned at least once for both mps to be awarded **ACCEPT** fructose may not be used by skin cells	(3)

Q8.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to three of the following: • insect is respiring carbohydrates at rest and lipid during flight (1) • respiration of carbohydrate provides enough energy for the insect at rest (1) • it requires more {energy / ATP} (for contraction) (1) • therefore the insect has to respire lipid to provide this energy (1)	**NB** uses for respires throughout but reference to respiration must be made at least once for full marks to be awarded **PIECE TOGETHER**	(3)