Respiration

Mark Scheme 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Energy and respiration
Sub Topic	Respiration
Booklet	Theory
Paper Type	Mark Scheme 2

Time Allowed : **72 minutes**

Score : **/ 60**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a) (i)** receptors / hypothalamus, detect change in blood temperature **;**

brain **;**

(receptor / brain) sends impulses to effector **;**

effector carries out response / example of response **;**

blood temperature returns to normal **;**

negative feedback **;** [max 4]

(ii) larger SA : V ratio **;**

lose (relatively) more heat **;**

ref. more mitochondria to release heat energy **;**

cannot carry out behavioural actions to get warm **;**

infants cannot shiver **;** [max 2]

(b) (i) **A** – ATP synthase / ATP synthetase / stalked particles **;** **R** ATPase

B – inner membrane / crista **;** **I** phospholipid bilayer [2]

(ii) arrow going down from intermembrane space to matrix **;** [1]

(iii) 1 **and** 3 **;** [1]

(iv) water **;** [1]

(v) fatty acids **;** **A** lipid / fat / triglycerides [1]

[Total:12]

2 **(a (i)** 1. ATP is made, in the electron transport chain/by oxidative phosphorylation**;**

2. oxygen is the final electron acceptor**;**

3. in the, inner membrane of the mitochondrion/cristae**;**

4. transfer of electron (between electron carriers) provides energy**;**

5. energy used to pump hydrogen ions (into intermembrane space)**;**

6. create proton gradient**;**

7. diffusion of hydrogen ions down their electrochemical gradient causes ATP to be synthesised**;**

8. ref. chemiosmosis/ATP synthase/stalked particles**;**

9. idea that if less oxygen (consumed/available) then fewer electrons transferred along the chain**;** [max 4]

(ii) 1. at high temperatures, reactions/enzyme activity/metabolism, faster**;**

2. because, molecules/enzymes/substrates, have more <u>kinetic</u> energy**;**

3. more frequent collisions**;**

4. therefore, respiration/Krebs cycle/electron transport chain/production of reduced NAD, take place at a faster rate**;**

5. idea of increase in rate of anabolic reactions (requiring more ATP)**;** [max 3]

(b) (i) 1. oxygen consumed = oxygen inhaled – oxygen exhaled**;**

2. measure oxygen consumption at rest (x) **and** after exercise stops (y)**;**

3. extra oxygen consumed/oxygen debt = y – x**;**

4. measure mass of lizard**;** [max 2]

(ii) 1. less (oxygen debt)(for *Varanus*)**; ora**

2. difference is greater at higher temperatures**;**

3. any two comparative figures at one temperature including units**;** [3]
A 102.0 cm^3 O_2 kg^{-1} at 30°C and 40°C

(iii) 1. *Varanus* uses, less anaerobic/more aerobic, respiration (when running)**;**

2. more ATP produced per glucose molecule**;**

3. able to run for long ti **;**

4. good chance of catching pr **;** [max 3]

(iv) *assume Varanus throughout*

1. larger surface area, in lungs/for gas exchange**;**

2. more oxygen absorbed into blood (per unit time)/faster rate of gas exchange**;**

3. more oxygen supplied to muscles (so oxygen debt lower)**;** [max 2]

[Total: 17]

3 **(a (i)** inner membrane / crista(e); [1]

(ii) 1. (electron comes from) hydrogen (atom); **R** H^+ / H_2

2. (from) reduced NAD / reduced FAD;

3. (from) dehydrogenation / oxidation, reactions;

4. (from substances in) Krebs cycle / link reaction / glycolysis;

5. in, matrix of mitochondrion / cytoplasm; [max 3]

(iii) 1. final electron acceptor / accepts electron from last carrier;

2. so carrier can be reduced again;

3. so electrons can keep flowing (along ETC) / so ETC can continue to work;

4. (oxygen) combines with H^+ to form water; [2 max]

(b) 1. (when pump stops working), resting potential not maintained
or
pump usually maintains the resting potential;

2. (during resting potential) membrane polarised
or
positive charge outside (neurone) / negative charge inside (neurone) / -70mV inside neurone relative to outside / potential difference across membrane;

3. (when pump stops working), ions (only) move by diffusion;

4. $^+$ **into** the neurone;

5. outward diffusion of K^+ is limited / K^+ stay in neurone;

6. ref. non voltage-gated channels;

7. (eventually) inside of the neurone, becomes less negative / contains (relatively) more positive ions
or
there is a reduced potential difference across the membrane; [max 4]

(ii) 1. voltage gated (calcium) channels open;

2. (calcium ions move in) by diffusion / move down their concentration gradient; [2]

(c) (i) 1. Na^+ / K^+, cannot move through membrane;

2. so potential across membrane maintained even when pump stops / so membrane depolarisation does not happen;

3. calcium ions cannot enter cell;

4. so, (destructive) enzymes not activated; [max 2]

(ii) 1. gene (for protein channels), expressed less / switched off;

2. transcription, reduced / stopped;

3. AVP; e.g. reduced aerobic respiration / less ATP, for transcription [max 2]

[Total: 16]

4 **(a** 1. reduced, NAD / FAD ;

2. passed to ETC ;

3. inner membrane / cristae ;

4. hydrogen released (from reduced, NAD / FAD) ; **R** H_2

5. split into electrons and protons ;

6. electrons pass along, carriers / cytochromes ;

7. ref. energy gradient ;

8. energ released pumps protons into intermembrane space ;

9. proto gradient ;

10. protons pass through (protein) channels ;

11. ATP synthase / stalked particles ;

12. (ATP produced from) ADP and inorganic phosphate ;

13. electron transferred to oxygen ;

14. addition of proton (to oxygen) to form water / (oxygen) reduced to water ; [8 max]

(b) 15. organisms need energy, to stay alive / for metabolism / AW ;

16. ATP as, (universal) energy currency / described ;

17. light energy for photosynthesis ; **A** light dependent stage

18. light-dependent stage detail ;

19. light-independent stage detail ;

20. chemical energy ;

21. for anabolic reactions ;

22. named reaction; e.g. protein synthesis / starch formation

23. activation of glucose in glycolysis / described ;

24. active transport ;

25. detail; e.g. sodium - potassium pump /movement against a concentration gradient

26. mechanical energy / movement ;

27. detail ; e.g. muscle contraction / spindle

28. temperature regulation ;

29. A ; e.g. bioluminescence / electrical discharge [7 max]

[Total: 15]