



9: Respiration – Topic questions

The questions in this document have been compiled from past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
4	2017	May/June	41
1	2017	May/June	42
7	2015	May/June	41

The mark scheme for each question is provided at the end of the document.

- 4 (a) ATP is used or produced at different stages in the respiration of glucose in aerobic conditions.

Complete the table to show whether ATP is used or produced at each stage of respiration.

Write either **YES** or **NO** in each box.

stage of respiration	ATP used	ATP produced
glycolysis		
link reaction		
Krebs cycle		
oxidative phosphorylation		

[2]

- (b) An experiment was carried out to investigate the effect of epicatechin on mitochondrial respiration in mice. Epicatechin is a naturally occurring compound in cocoa beans and so is present in chocolate.

Two groups of mice, group **A** and group **B**, were used in this experiment.

- Group **A** was given water containing epicatechin, twice a day for 15 days.
- Group **B** was given water without epicatechin, twice a day for 15 days.

After 15 days, the structure of mitochondria from striated muscle cells in both groups of mice was examined.

The surface area of the inner membrane of the mitochondria was divided by the surface area of the outer membrane to obtain a ratio for each mouse.

Table 4.1 shows the mean ratios for the two groups of mice.

Table 4.1

group	mean ratio
A	2.0 : 1
B	1.7 : 1

The mice in group **A** were able to exercise longer than the mice in group **B**.

With reference to Table 4.1, explain why the mice in group **A** were able to exercise for longer than the mice in group **B**.

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..... [5]

[Total: 7]

Section A

Answer **all** the questions.

- 1 (a) Fig. 1.1 represents the link reaction.

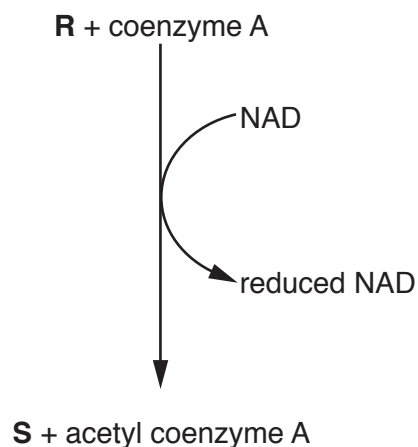


Fig. 1.1

With reference to Fig. 1.1:

- (i) name substances **R** and **S**

R

S [2]

- (ii) explain what happens to the reduced NAD.

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..... [2]

- Name the waste products that are excreted **and** describe what occurs to these products to help return the pH of the blood back to a normal level.

[Total: 9]

[6]

(b) Within a mammalian cell, ATP can be produced in a number of ways, including:

- substrate level phosphorylation during the Krebs cycle
- oxidative phosphorylation.

Table 7.1 compares both processes.

Complete Table 7.1.

Use a tick (✓) if the statement is correct or a cross (✗) if the statement is incorrect.
The first row has been done for you.

Table 7.1

statement	substrate level phosphorylation	oxidative phosphorylation
enzymes are involved	✓	✓
occurs in cytoplasm		
occurs in mitochondria		
channel proteins are involved		

- (c) An investigation into the RQ values of germinating maize seeds was carried out.
- A sample of maize seeds was soaked in water for one hour.
 - The mean RQ value of some of the seeds was then calculated and the remaining seeds were then planted in soil.
 - After 12 hours, the mean RQ value of some of the planted seeds was calculated.
 - The remaining seeds were allowed to germinate and grow into seedlings.
 - After 21 days, the mean RQ value of some of the seedlings was calculated.

Table 7.2 shows the results of the investigation.

Table 7.2

stage of germination and growth	mean RQ
seeds soaked in water	5.6
seeds after 12 hours in the soil	0.8
seedlings after 21 days	1.0

Suggest an explanation for each of the RQ values shown in Table 7.2.

seeds soaked in water

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seeds after 12 hours in the soil

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seedlings after 21 days

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..... [6]

[Total: 15]

Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
AW	alternative wording (where responses vary more than usual)
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point

Question	Answers	Marks															
4(a)	<table> <tr> <th>stage of respiration</th><th>ATP used</th><th>ATP produced</th></tr> <tr> <td>glycolysis</td><td>yes</td><td>yes</td></tr> <tr> <td>link reaction</td><td>no</td><td>no</td></tr> <tr> <td>Krebs cycle</td><td>no</td><td>yes</td></tr> <tr> <td>oxidative phosphorylation</td><td>no</td><td>yes</td></tr> </table> <p>4 correct = 2 marks, 2 or 3 rows correct = 1 mark If ticks and crosses used need all 4 correct for maximum 1 mark</p>	stage of respiration	ATP used	ATP produced	glycolysis	yes	yes	link reaction	no	no	Krebs cycle	no	yes	oxidative phosphorylation	no	yes	2
stage of respiration	ATP used	ATP produced															
glycolysis	yes	yes															
link reaction	no	no															
Krebs cycle	no	yes															
oxidative phosphorylation	no	yes															

4(b)	<p><i>max 5 of:</i></p> <p><i>group A (accept ora for group B throughout) accept 'they' = group A</i></p> <p>1 higher <u>ratio</u> ;</p> <p>2 larger / more, inner membrane / cristae (than B) ;</p> <p>3 more, ETCs / cytochromes / ATP synth(et)ase / stalked particles ; I ATPase</p> <p>4 oxidative phosphorylation ;</p> <p>5 more ATP produced ;</p> <p>6 <u>muscles</u> can contract for, longer / more time / without getting tired ; I exercise longer I muscles contract faster</p> <p>7 AVP ; e.g. chemiosmosis or detail thereof:</p> <p>H⁺ move, down gradient / through ATP synth(et)ase I ATPase</p> <p><i>If B and A switched round penalise once only</i></p>	5
		Total: 7

Question	Answers	Marks
1(a)(i)	R – pyruvate ; S – carbon dioxide ;	2
1(a)(ii)	<i>idea that</i> , hydrogen(s) / protons and electrons, are released ; A (reduced NAD), oxidised / dehydrogenated at ETC / (for) oxidative phosphorylation ;	2
1(b)	1. lactate (produced) ; A lactic acid 2. (lactate) taken to liver ; 3. converted to pyruvate ; 4. (pyruvate) converted to, glucose / glycogen ; 5. carbon dioxide (produced) ; 6. <i>ref. to</i> carbon dioxide / pH, receptors ; 7. (carbon dioxide) goes into alveoli ; 8. increased breathing (rate) ; 9. <i>ref. to</i> haemoglobin acts as a buffer for carbon dioxide ;	max 5
		Total: 9

Question	Answers	Marks
7(a)	<p>1 glucose phosphorylated by ATP ;</p> <p>2 (forms) hexose / fructose, biphosphate ;</p> <p>3 raises energy level of / activates, glucose / sugar</p> <p>OR</p> <p>lowers activation energy of reaction ;</p> <p>4 breaks down to two TP ;</p> <p>5 $6C \rightarrow 2 \times 3C$;</p> <p>6 hydrogen (atoms) removed / dehydrogenated / oxidised ;</p> <p>7 2 reduced NAD formed ; A NADH / NADH₂</p> <p>8 ref. to 4 ATP produced / net gain of 2 ATP ;</p> <p>9 pyruvate produced ;</p> <p>10 AVP ; e.g. ref. to substrate level phosphorylation / dehydrogenase / phosphofructokinase / hexokinase</p>	max 6

7(b)	<table><tr><td></td><td>substrate level phosphorylation</td><td>oxidative phosphorylation</td><td></td></tr><tr><td>enzymes are involved</td><td>✓</td><td>✓</td><td></td></tr><tr><td>occurs in cytoplasm</td><td>✓</td><td>x</td><td>;</td></tr><tr><td>occurs in mitochondria</td><td>✓</td><td>✓</td><td>;</td></tr><tr><td>channel proteins are involved</td><td>x</td><td>✓</td><td>;</td></tr></table>		substrate level phosphorylation	oxidative phosphorylation		enzymes are involved	✓	✓		occurs in cytoplasm	✓	x	;	occurs in mitochondria	✓	✓	;	channel proteins are involved	x	✓	;	3
	substrate level phosphorylation	oxidative phosphorylation																				
enzymes are involved	✓	✓																				
occurs in cytoplasm	✓	x	;																			
occurs in mitochondria	✓	✓	;																			
channel proteins are involved	x	✓	;																			
7(c)	<p>seeds soaked in water</p> <p>1 little / no, oxygen (in water) ;</p> <p>2 (mostly) anaerobic respiration ;</p> <p>seeds after 12 hours in the soil</p> <p>3 (more) aerobic respiration / less anaerobic respiration ;</p> <p>4 mixture of substrates ; e.g. 2 of carbohydrates, proteins and lipids</p> <p>seedlings after 21 days</p> <p>5 aerobic respiration ;</p> <p>6 substrate is, glucose / carbohydrate ;</p> <p>7 ref. to presence of leaves / photosynthesis ;</p>	max 6																				
		Total: 15																				