



Topics for this weeks class:

Glycolysis The Link Reaction Krebs Cycle Oxidative Phosphorylation Anaerobic Respiration

Playlist of videos to take notes on before the web class:

AQA VIDEOS	OCR VIDEOS	EDEXCEL VIDEOS
Introduction To Respiration	Introduction To Respiration	Introduction To Respiration
<u>Glycolysis</u>	<u>Mitochondria</u>	<u>Mitochondria</u>
The Link Reaction	Glycolysis	Glycolysis
Krebs Cycle	The Link Reaction	The Link Reaction
Oxidative Phosphorylation	Krebs Cycle	Krebs Cycle
Anaerobic Respiration - Glycolysis	Oxidative Phosphorylation	Oxidative Phosphorylation
Respiratory Substrates	Anaerobic Respiration - Glycolysis	Chemiosmotic Theory
Mitochondria	Respiratory Substrates	Anaerobic Respiration - Glycolysis
	Respiratory Quotient	Lactate
		Respiratory Substrates



RESPIRATION



(4)



(a) Exercise causes an increase in heart rate.

Describe the role of receptors and of the nervous system in this process.

(b) AMP-activated protein kinase (AMPK) is an enzyme that regulates a number of cellular processes. Exercise leads to activation of AMPK.

The diagram shows one effect of activation of AMPK during exercise.

AMPK
Acetyl-CoA — Malonyl-CoA
Leads to inhibition of
CPT1 transport of fatty acids
CPT1 is a channel protein that transports fatty acids into mitochondria.
Using the diagram above, explain the benefit of activation of AMPK during exercise.
(3) (Total 7 marks)

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Q2.

(a) A student measured the rate of aerobic respiration of a woodlouse using the apparatus shown in the diagram.



(i) The student closed the tap. After thirty minutes the drop of coloured liquid had moved to the left. Explain why the drop of coloured liquid moved to the left.

(ii) What measurements should the student have taken to calculate the rate of aerobic respiration in mm³ of oxygen g⁻¹ h⁻¹?



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(b) DNP inhibits respiration by preventing a proton gradient being maintained across membranes. When DNP was added to isolated mitochondria the following changes were observed

 less ATP 	was	produced
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- more heat was produced
- the uptake of oxygen remained constant.

Explain how DNP caused these changes.

((3) Total 9 marks)

ored RESPIRATION



Q3.

(a) The main stages in anaerobic respiration in yeast are shown in the diagram.







(b) Give two ways in which anaerobic respiration of glucose in yeast is

(i) similar to anaerobic respiration of glucose in a muscle cell

1	
2	

(ii) different from anaerobic respiration of glucose in a muscle cell.

1	
2	
	(2)

(c) Some students investigated the effect of temperature on the rate of anaerobic respiration in yeast. The apparatus they used is shown in the diagram. The yeast suspension was mixed with glucose solution and the volume of gas collected in five minutes was recorded.



(i) Each student repeated the experiment and the results were pooled. Explain the advantages of collecting a large number of results.



(2)



(ii) At 30 °C, one student obtained the following results.

Volume of gas collected in 5	Result 1	Result 2	Result 3
minutes / cm ³	38.3	27.6	29.4

Calculate the mean rate of gas production. Give your answer in $\text{cm}^3 \text{ s}^{-1}$.

	Answer cm ³	s ⁻¹ (2)
(iii)	If aerobic respiration had been investigated rather than anaerobic respiration, how would you expe the volumes of gas collected at 30°C to differ from these results?	ect
	Explain your answer.	
		(3)
	(Total 15 mar	ks)

Tailored RESPIRATION

Q4.



	1.		
	2.		(1)
(b)	(i)	If there is a shortage of oxygen in muscle cells during exercise, some pyruvate is converted into lactate Explain why muscles become fatigued when insufficient oxygen is available.	.
	(ii)	Some of the lactate is oxidised to pyruvate by muscles when they are well-supplied with oxygen. Suggest an advantage of the lactate being oxidised in the muscles.	(2)
		 	(2) ks)





Q5. (a)	Descr	ibe how acetylcoenzyme A is formed in the link reaction.	
			(2)
(b)	In the read	• Krebs cycle, acetylcoenzyme A combines with four-carbon oxaloacetate to form six-carbon citrate. Th ction is catalysed by the enzyme citrate synthase.	is
	(i)	Oxaloacetate is the first substrate to bind with the enzyme citrate synthase. This induces a change in the enzyme, which enables the acetylcoenzyme A to bind.	ו
		Explain how oxaloacetate enables the acetylcoenzyme A to then bind to the enzyme.	
			(2)
	(ii)	Another substance in the Krebs cycle is called succinyl coenzyme A. This substance has a very similar shape to acetylcoenzyme A.	ſ
		Suggest how production of succinyl coenzyme A could control the rate of the reaction catalysed b citrate synthase.	у
			(2)





- (c) In muscles, pyruvate is converted to lactate during anaerobic respiration.
 - (i) Explain why converting pyruvate to lactate allows the continued production of ATP during anaerobic respiration.

(ii) In muscles, some of the lactate is converted back to pyruvate when they are well supplied with oxygen. Suggest **one** advantage of this.





Q6.

(a) The table contains statements about three stages of respiration.

Complete the table with a tick if the statement in the first column is true for each stage of respiration in an animal.

			Glycolysis	Link reaction	Krebs cycle
Occurs in	mitocho	ondria			
Carbon d	lioxide p	produced			
NAD is r	educed				
(b) The following reactio A scientist investigo malonate is very sin substrate, pyruvate suspension. (i) Explain why ti mitochondr			on occurs in the Krebs cycle. Enzy Succinate atted the effect of the enzyme ir milar to the structure of succinc , to a suspension of isolated m he scientist did not use glucose ia.	The scientist added malo itochondria. She also bubble as the respiratory substrate	ction. The structure of nate and the respiratory ad oxygen through the for these isolated
	(ii)	Explain how r	nalonate inhibits the formation	of fumarate from succinate.	
	(iii)	The scientist m of oxygen c	neasured the uptake of oxyger decreased when malonate was	n by the mitochondria during s added. Explain why.	the investigation. The uptak
					(Total 9 marl

ailored RESPIRATION

OR

(a) 1. Chemoreceptors detect rise in CO_2 / H+ / acidity / carbonic acid / fall in pH

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Q1.



 Baro / pressure receptors detect rise in blood pressure 2. Send impulses to cardiac centre / medulla 3. More impulses to SAN 4. By sympathetic (nervous system for chemoreceptors / CO;) OR By parasympathetic (nervous system for baro / pressure receptors / blood pressure) Ignore: incortion of receptors. Ignore: incortion of receptors. Ignore: incortion of receptors. Ignore: incortion of neerptors. Ignore: incortion of neerptors. Ignore: incortion of receptors. Ignore: incortion of neerptors. Ignore: incortion of nationyl-CoA (b) I. Less / no malonyl-CoA Imbibition of malonyl-CoA in this own is not enough but accept production of malonyl-CoA is inhibited. Respiration / axidation of fatty acids provides AIP Inhibition of malonyl-CoA is inhibited. Ignore: incortion of receptors. Ignore: incortion of receptors.<!--</th--><th></th><th></th><th></th>			
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		3. Oxygen used as final electron acceptor / combines with electrons (and protons)	
_			3
[9			[9]



03			•	
40	(a)	(i)	glycolysis	
				1
		(ii)	oxygen removed from pyruvate / reduced NAD is oxidised / donates hydrogen / donates electrons	-
		(:::)	allow NAD to be used if the formed	1
		(111)	so that glycolysis / described / candidates answer to (i) can proceed / so that (more) glucose can be converted to pyruvate / so that process X can continue	
	4. 5	43		2
	(b)	(i)	ATP formed / used pyruvate formed / reduced NAD / reduced NAD	
			glycolysis involved / two stage process	
		4.3		2 max
		(ii)	ethanol / alcohol formed by yeast, lactate (<i>allow lactic acid</i>) by muscle cell CO ₂ released by yeast but not by muscle cell	
			(note: need both parts of the comparison for the mark)	-
	()	(-)		2
	(C)	(1)	allows anomalies to be identified / increases reliability (of means / averages / results)	
			allows use of statistical test	
		4.3		2
		(ii)	= 31.8 / 31.76 / 31.77	
			(units not required) $(5 \times 40) = 0.104 + 0.11 + 0.1$	
			\div (5 \times 60) = 0.100 / 0.11 / 0.1	
			(correct mean volume (31.8 cm ³) however derived scores 1 mark)	
				2
		(iii)	Volume(s) less / no gas evolved	
			30 (volume) CO ₂ evolved – (volume of) O ₂ taken in	3
				[15]
Q4.				1-01
	(a)	CO2, water, ATP, reduced NAD / FAD		
			(accept creatine phosphate)(any 2 - one tick)	
				1
	(b)	(i)	build up / increased concentration of lactate lowers	
			enzymes / named protein inhibited(not denatured)	
				2
		(ii)	lactate / pyruvate is an energy source	
			muscles have increased / immediate energy or ATP supply (accept lactate replenishes alvoagen or alvoase)	
			restores pH levels	
				2 max
				[5]

Tailored Tutors RESPIRATION



Q5.				
	(a)	l.	Oxidation of / hydrogen removed from pyruvate and carbon dioxide released	
		Ζ.		
			Accept: NAD reduced for oxidation	•
	<i>(</i> 1.)	<i>(</i> -)		2
	(b)	(i)	1. Change (in shape) of active site / active site moulds around the substrate	
			Reject: reference to inhibitor	
			Accept: change in tertiary structure affecting active site	
			(Substrate / active site) now <u>complementary</u>.	
			Neutral: references to two active sites	
				2
		(ii)	1. Is a competitive inhibitor / attaches to active site	
		(Neutral: reference to inhibitor forming an enzyme-substrate complex	
			2 Reduces / prevents enzyme-substrate / E-S complex forming	
			2. Accord: Poducos / provents acot / construct / 2.5 complex forming.	
			synthase	
				2
	(c)	(i)	1 Regenerates / produces NAD / oxidises reduced NAD	-
	(C)	(1)	2. (NAD used) in altracticia	
			2. (IVAD Used) III giycolysis.	
			Accept: glycolysis can continue / begin	•
				2
		(ii)	(Pyruvate used) in aerobic respiration / (lactate / lactic acid) is toxic / harmful / causes cramp / (muscle) fatigue.	
			Accept: (pyruvate) can enter link reaction	
			Accept: reduces cramp / (muscle) fatigue	
			Neutral: 'reduces muscle aches'	
				1
				[0]
				141





Q6.

(a)

(b)

		Glycolysis	Link reaction	Krebs cycle					
Oc	curs in mitochondria		\checkmark	\checkmark					
Ca	rbon dioxide produced		\checkmark	\checkmark					
N	AD is reduced	\checkmark	\checkmark	\checkmark					
Marl	< horizontally	•							
	 Accept: glucose mark Glucose cannot crc membrane(s) 	 Accept: glucose to pyruvate or glucose not converted to pyruvate for one mark Glucose cannot cross mitochondrial <u>membrane(s)</u> / pyruvate can cross mitochondric membrane(s) 							
(ii)	 Is a competitive inhibitor / attaches to active site Accept: inhibitor / malonate attaches to active site to form an enzyme-substrate complex Reduces / prevents enzyme-substrate / E-S complex forming Accept: substrate / succinate cannot bind to enzyme Accept mark point 2, but not mp1 in context of non-competitive inhibition 								
(iii)	 Krebs cycle inhibited c Hydrogens not pass 	as NAD / Coenzyme , sed to ETC therefore	/ FAD not / less reduced oxygen not used as (mu	uch as a) final / tern					

(electron) acceptor

2

3

2