

Biology GCSE Revision

## Topic 4

# Bioenergetics

- Photosynthesis
- Respiration & Exercise

# Mark Scheme

BL2HP

Question 1 continued . . .

question	Answers	extra information	mark
1(c)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
	<b>0 marks</b>	<b>Level 1 (1-2 marks)</b>	<b>Level 2 (3-4 marks)</b>
	No relevant content.	There is a brief description of at least 1 tissue or at least 1 function of an indicated part of the leaf.  The account lacks clarity or detail.	There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.
			<b>Level 3 (5-6 marks)</b>
			There is a detailed description of most of the structures and their functions.
<p><b>examples of responses:</b></p> <ul style="list-style-type: none"> <li>• epidermis</li> <li>• cover the plant</li> <li>• mesophyll / palisade</li> <li>• photosynthesises</li> <li>• phloem</li> <li>• xylem</li> <li>• transport.</li> </ul> <p><b>The following points are all acceptable but beyond the scope of the specification:</b></p> <ul style="list-style-type: none"> <li>• (waxy) cuticle – reduce water loss</li> <li>• epidermis – no chloroplasts so allows light to penetrate</li> <li>• stomata / guard cells – allow CO<sub>2</sub> in (and O<sub>2</sub> out) or controls water loss</li> <li>• palisade (mesophyll) – <u>many</u> chloroplasts to trap light – near top of leaf for receiving more light</li> <li>• spongy (mesophyll) – air spaces for rapid movement of gases</li> </ul>			
<b>Total</b>			<b>9</b>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2			6	AO1/2/3 2.3.1a/b/c/d +prac
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content.	A partial description of how the apparatus is set up <b>or</b> a description of how light is supplied <b>or</b> a simple description of how photosynthesis can be measured. <b>or</b> a control variable	A description of how the apparatus is set up <b>and</b> a description of how photosynthesis can be measured. <b>or</b> a description of how light intensity is varied <b>or</b> a control variable <b>or</b> any other relevant point	A description of how the apparatus is used to measure the <b>rate of</b> photosynthesis at different light <b>intensities</b> is given.  For full marks reference must be made to a control variable <b>or</b> repeats	
<b>examples of the points made in the response</b> <ul style="list-style-type: none"> <li>• apparatus set up: <ul style="list-style-type: none"> <li>– weed in water in beaker</li> <li>– light shining on beaker</li> </ul> </li> <li>• method of varying the light intensity – eg changing distance of lamp from plant</li> <li>• method of controlling other variables <ul style="list-style-type: none"> <li>– use same pond weed <b>or</b> same length of pond weed</li> <li>– temperature: water bath or heat screen</li> <li>– CO<sub>2</sub></li> </ul> </li> <li>• leave sufficient time at each new light intensity before measurements taken</li> <li>• method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas &amp; measuring volume in a syringe</li> <li>• measuring <b>rate of photosynthesis</b> by counting bubbles for set period of time</li> <li>• repetitions</li> </ul>		<b>extra information</b> allow information in the form of a diagram		
<b>Total</b>			<b>6</b>	

**Question 5**

question	answers	extra information	mark
5(a)	LHS – carbon dioxide / CO <sub>2</sub>	allow CO <sub>2</sub> ignore CO <sup>2</sup>	1
	RHS glucose / carbohydrate / sugar	in either order allow starch allow C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> / C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ignore C <sup>6</sup> H <sup>12</sup> O <sup>6</sup>	1
	oxygen	allow O <sub>2</sub> / O <sub>2</sub> ignore O <sup>2</sup> / O	1

Question 5 continues on the next page...

question	answers	extra information	mark
5(b)	<p>any five from:</p> <ul style="list-style-type: none"> <li>factor 1: CO<sub>2</sub> (concentration)</li> <li>effect - as CO<sub>2</sub> increases so does rate and then it levels off or shown in a graph</li> <li>explanation: (graph increases) because CO<sub>2</sub> is the raw material or <u>used</u> in photosynthesis / converted to organic substance / named eg</li> </ul> <p>or</p> <p>(graph levels off) when another factor limits the rate.</p> <ul style="list-style-type: none"> <li>factor 2: temperature</li> <li>effect – as temperature increases, so does the rate and then it decreases or shown in a graph</li> <li>explanation: (rise in temp) increases rate of chemical reactions / more kinetic energy</li> </ul> <p>or</p> <p>(decreases) because the enzyme is denatured.</p>	<p>accept points made via an annotated / labelled graph</p> <p>allow warmth / heat</p> <p>allow 'it peaks' for description of both phases</p> <p>allow molecules move faster / more collisions</p> <p>context must be clear = high temperature</p> <p>allow other factor plus effect plus explanation: eg light wavelength / colour / pigments / chlorophyll / pH / minerals / ions / nutrients / size of leaves</p> <p>2<sup>nd</sup> or 3<sup>rd</sup> mark can be gained from correct description and explanation</p>	5
<b>Total</b>			<b>8</b>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	<u>light</u> is trapped / absorbed / used	extra answers cancel mark ignore solar / sunshine	1	AO1 2.3, 2.3.1a,b
	by chlorophyll / chloroplasts	if no other marks awarded, allow 1 mark for photosynthesis / equation for photosynthesis	1	
7(b)	(to make) starch (for storage)	ignore 'for growth' unqualified ignore respiration	1	AO1 2.3.1e,f, 2.6.1f
	(to make) fat / oil (for storage)		1	
	(to make) amino acids / proteins / enzymes		1	
	(to make) cellulose / cell walls	allow for active transport allow any other correct, named organic substances (eg DNA / ATP / chlorophyll / hormone)  if no named examples, allow 'to make <b>named</b> cell structures' for max. 1 mark	1	
Total			6	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	carbon + water $\longrightarrow$ glucose + oxygen dioxide	LHS = 1 mark RHS = 1 mark  allow sugar instead of glucose, ignore starch allow correct formulae: $H_2O$ , $CO_2$ , $C_6H_{12}O_6$ and $O_2$ if words <b>and</b> formulae given, accept correct words and ignore incorrect formulae ignore balancing ignore light / heat / energy / chlorophyll on LHS do <b>not</b> allow light / heat / energy on RHS	2	AO1 2.3.1a
4(b)(i)	16	allow answers in range 15.8 to 16.2	1	AO2 2.3 2.3.1c
4(b)(ii)	25 (%)	ignore 0.25 allow ecf from answer to <b>bi</b>	1	AO2 2.3 2.3.1c
4(b)(iii)	no extra photosynthesis or maximum rate is reached  (so) no extra yield or less profit or not cost-effective or waste of money	ignore graph levels off  allow $CO_2$ not limiting or another factor is limiting (the rate of photosynthesis)  ignore cost unqualified	1  1	AO2/AO3 2.3 2.3.1c

4(b)(iv)	increased temperature	allow use of a heater	1	AO1 2.3, 2.3.1c,d
	increased light (intensity)	allow turn on lamps	1	
		allow increased minerals / ions / salts / water / correct named example		
		if no other marks awarded allow one mark for temperature and light		
Total			8	



BLY2H

## Question 4

question	answers	extra information	mark
4(a)	less carbon dioxide <u>used</u> or higher carbon dioxide (concentration) in jar	do <b>not</b> allow no carbon dioxide used or no change in carbon dioxide	1
	because <u>less</u> photosynthesis or light was a limiting factor	do <b>not</b> allow no photosynthesis	1
4(b)	magnesium / Mg	do <b>not</b> allow manganese / Mn  allow iron / Fe  ignore nitrates	1
Total			3

## BL2HP

## Question 5

question	answers	extra information	mark
5(a)	LHS: carbon dioxide <b>AND</b> water	in either order  accept $\text{CO}_2$ and $\text{H}_2\text{O}$ allow $\text{CO}_2$ and $\text{H}_2\text{O}$ if names given ignore symbols  do <b>not</b> accept $\text{CO}^2$ / $\text{H}^2\text{O}$ / Co / CO ignore balancing	1
	RHS: sugar(s) / glucose / starch / carbohydrate(s)	accept $\text{C}_6\text{H}_{12}\text{O}_6$ allow $\text{C}_6\text{H}_{12}\text{O}_6$ do <b>not</b> accept $\text{C}^6\text{H}^{12}\text{O}^6$	1
5(b)(i)	light is needed for photosynthesis  <b>or</b>  no photosynthesis occurred (so no oxygen produced)		1
5(b)(ii)	oxygen is needed / used for (aerobic) respiration	full statement  respiration occurs <b>or</b> oxygen is needed for anaerobic respiration gains 1 mark	2
5(c)(i)	(with increasing temperature) rise then fall in rate		1
	use of figures, ie max. production at $40^\circ\text{C}$ <b>or</b> maximum rate of 37.5 to 38		1

Question 5 continues on the next page . . .

## BL2HP

## Question 5 continued

question	answers	extra information	mark
5(c)(ii)	<u>25 – 35 °C</u>  <b>either</b> faster movement of particles / molecules / more collisions <b>or</b> particles have more energy / enzymes have more energy  <b>or</b> temperature is a limiting factor over this range  <u>40 – 50 °C</u>  denaturation of proteins / enzymes		1
		ignore denaturation of cells ignore stomata	1
5(d)	above 35 °C (to 40 °C) – little increase in rate <b>or</b> >40 °C – causes decrease in rate		1
	so waste of money <b>or</b> less profit / expensive		1
	because respiration rate is higher at >35 °C <b>or</b> respiration reduces the effect of photosynthesis		1
<b>Total</b>			<b>12</b>

# Respiration & Exercise

## Question 4

question	answers	extra information	mark
4(a)	A = cytoplasm B = (cell) membrane		1 1
4(b)	in yeast: <u>makes</u> alcohol / <u>makes</u> CO <sub>2</sub> / does not <u>make</u> lactic acid	'it' equals yeast do not allow uses / involves alcohol / CO <sub>2</sub>	1
4(c)(i)	any two from: <ul style="list-style-type: none"> <li>• volume of yeast / suspension</li> <li>• volume of sugar / solution</li> <li>• concentration of sugar</li> <li>• temperature</li> </ul>	allow amount of yeast amount of sugar = max 1 for sugar  (total) volume = 1 mark if no other volume  ignore concentration of yeast	2
4(c)(ii)	most / more CO <sub>2</sub> given off with fructose <b>or</b> faster CO <sub>2</sub> production <b>or</b> faster respiration  so (rate of) alcohol production will be greatest / more (with fructose)	'it' equals fructose  allow faster fermentation do not allow aerobic respiration	1  1
Total			7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	without <u>oxygen</u>	allow not enough oxygen ignore air ignore production of CO <sub>2</sub> ignore energy	1	AO1 2.6, 2.6.2a
1(a)(ii)	more/high/increased lactic acid (at end)	allow approximate figures (to show increase) ignore reference to glucose	1	AO3 2.6, 2.6.2b
1(b)(i)	1.5	allow only 1.5 / 1½ / one and a half	1	AO3 2.6, 2.6.1g/h
1(b)(ii)	increases at first <b>and</b> levelling off  suitable use of numbers eg rises to 10 / by 9 (dm <sup>3</sup> per min) <b>or</b> increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale) <b>or</b> after the first minute (of the run)	ignore subsequent decrease     allow answer in range 1.4 to 1.5	1  1	AO2 2.6, 2.6.1g/h
1(b)(iii)	<div> supplies (more) oxygen  supplies (more) glucose  for (more) respiration  releases (more) energy (for muscle contraction) </div>	need 'more/faster' once only for full marks  allow removes (more) CO <sub>2</sub> / lactic acid / heat as an alternative for either marking point one or two, <b>once only</b>  do <b>not</b> allow energy production or <b>for</b> respiration	1  1  1  1	AO1 2.6.1b/ef/g/h 2.6.2d
<b>Total</b>			<b>9</b>	

Question	Answers	Extra information	Mark	AO / spec ref.
3(a)	<u>anaerobic respiration</u>	allow phonetic spelling	1	AO1 2.6.2a, b,d
3(b)(i)	4.4	<p>4.2, 4.3, 4.5 or 4.6 with figures in tolerance (6.7 to 6.9 and 2.3 to 2.5) and correct working gains 2 marks</p> <p>4.2, 4.3, 4.5 or 4.6 with no working shown or correct working with one reading out of tolerance gains 1 mark</p> <p>correct readings from graph in the ranges of 6.7 to 6.9 and 2.3 to 2.5 but no answer / wrong answer gains 1 mark</p>	2	AO2 2.6.2a, b,d
3(b)(ii)	<p>more energy is needed / used / released (at 14 km per hour)</p> <p>not enough oxygen (can be taken in / can be supplied to muscles)</p> <p>so more <u>anaerobic</u> respiration (to supply the extra energy) or more glucose changed to lactic acid</p>	<p>do <b>not</b> allow energy production ignore work</p> <p>allow reference to oxygen debt do <b>not</b> allow less / no oxygen</p> <p>allow not enough aerobic respiration</p>	<p>1</p> <p>1</p> <p>1</p>	AO1 / AO2 2.6.2a, b,d
<b>Total</b>			<b>6</b>	

## BL2HP

## Question 1

question	answers	extra information	mark
1(a)(i)	<p>any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• age (of athlete)</li> <li>• gender (of athlete)</li> <li>• <u>starting</u> concentration of glycogen</li> <li>• type / intensity of exercise</li> <li>• length of exercise period</li> <li>• number of training sessions</li> <li>• time interval between exercise sessions</li> <li>• exercise at same time of day</li> </ul>	<p>if diet given as answer = max 2</p> <p>if none of these points gained amount of exercise = 1 mark</p> <p>if last four points not awarded allow time (for exercise) for 1 mark ignore references to amount of energy ignore they are both athletes</p>	3
1(a)(ii)	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• intensity of exercise</li> <li>• amount of exercise between sessions</li> <li>• <u>starting</u> concentration of glycogen</li> <li>• fitness / health</li> <li>• metabolic rate / respiration rate</li> <li>• amount / mass of <u>muscle</u> / physique</li> <li>• aspects of diet qualified, eg amount of food eaten</li> </ul>	<p>do <b>not</b> accept amount of carbohydrate</p> <p>if no other marks awarded allow height / mass / weight for 1 mark</p>	2



<b>1(a)(iii)</b>	<p>(B has) less glycogen</p> <p>or (B's glycogen) fell more</p> <p>or (B's glycogen) built up less</p>	<p>he = B</p> <p>accept use of approximate figures</p> <p>allow other correct observations from graph eg A is lower at end of first session</p> <p>ignore rate of fall</p>	<b>1</b>
<b>1(b)</b>	<p>athlete A (no mark)</p> <p>athlete A had more glycogen / B has less (only if A chosen to complete marathon)</p> <p>(glycogen / glucose) used in respiration</p> <p>(more) energy released / available in athlete A</p> <p>and either energy used for movement / muscle action / to run</p> <p>or</p> <p>(extra) glycogen → (more) glucose</p>	<p>to gain full marks 'more' must be given at least once</p> <p>accept converse argument for B</p> <p>ignore anaerobic</p> <p>allow 'energy made'</p>	<p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p>
<b>Total</b>			<b>10</b>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	5624	<p>allow 2 marks for:</p> <ul style="list-style-type: none"> <li>correct HR = 148 and correct SV = 38 plus wrong answer / no answer</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>only one value correct and ecf for answer</li> </ul> <p>allow 1 mark for:</p> <ul style="list-style-type: none"> <li>incorrect values and ecf for answer</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>only one value correct</li> </ul>	3	AO2 2.6, 2.6.1g
5(b)(i)	Person 2 has low(er) stroke volume / SV / described	<p>eg Person 2 pumps out smaller volume each beat</p> <p>do not allow Person 2 has lower heart rate</p>	1	AO3 2.6, 2.6.1g
5(b)(ii)	<p>Person 1 sends <u>more blood</u> (to muscles / body / lungs)</p> <p>(which) supplies (more) oxygen</p> <p>(and) supplies (more) glucose</p> <p>(faster rate of) respiration or transfers (more) energy for use</p> <p>removes (more) CO<sub>2</sub> / lactic acid / heat</p> <p>or less lactic acid made</p> <p>or (more) muscle contraction / less muscle fatigue</p>	<p>ignore aerobic / anaerobic</p> <p>allow (more) energy release</p> <p>allow aerobic respiration transfers / releases more energy (than anaerobic)</p> <p>do not allow makes (more) energy</p> <p>allow less oxygen debt</p> <p>if no other mark awarded, allow person 1 is fitter (than person 2) for max 1 mark</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	AO1 / AO2 2.6.1b,e,f,g,h, 2.6.2c,d
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	any two from: <ul style="list-style-type: none"> <li>to avoid a psychological effect or avoid cyclists trying harder in one session or avoid cyclists pedalling for longer</li> <li>to avoid bias(ed results)</li> <li>to show the true effect of consuming glucose or to give a valid comparison</li> </ul>		2	AO2/3 2.6 2.6.1b/f

5(b)(i)	<p>any four from:</p> <p>Pro:</p> <ul style="list-style-type: none"> <li>• exercise is standardised / same intensity / same cyclists</li> <li>• results show blood glucose level doesn't fall too low with glucose drink</li> <li>• extra hour of cycling or cycle longer with glucose drink / with higher blood glucose</li> <li>• it was a blind trial or cyclists don't know if they are taking a placebo</li> </ul> <p>Con:</p> <ul style="list-style-type: none"> <li>• sample size is too small or <b>only 7</b></li> <li>• no other athletes tested or <b>only</b> tested on cyclists</li> <li>• <b>only</b> tested once / no repetition</li> <li>• effect may be due to hydration level (as opposed to glucose)</li> <li>• other factors before / outside of the sessions may not be controlled, e.g. diet, training regime, drugs, health</li> <li>• no data concerning variation between individuals' results</li> <li>• should have been a double-blind trial</li> </ul>	<p>max 3 marks for only pros or cons given</p> <p>points must clearly relate to a pro or con</p> <p>allow with glucose drink, blood glucose stays high or stays higher than placebo</p> <p>allow suggested improvement – e.g. should have some cycling with and some without glucose at same time, then swap for 2<sup>nd</sup> session</p>	4	<p>AO3</p> <p>2.6</p> <p>2.6.1b/f</p> <p>2.6.2d</p>
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5(b)(ii)	increased <u>oxygen</u> supply	'increased' / 'more' must be given at least once for full marks	1	AO1 2.6.1b/f/g/h 2.6.2d
	increased removal of <u>carbon dioxide</u>	allow idea of less lactic acid <b>or</b> less (muscle) fatigue <b>or</b> less oxygen debt <b>or</b> less anaerobic respiration	1	
	increased <u>respiration</u>	do <b>not</b> allow increased anaerobic respiration	1	
	so increased <u>energy</u> release for muscle contraction / action	do <b>not</b> allow makes (more) energy	1	
<b>Total</b>			<b>10</b>	