GCE A LEVEL MARKING SCHEME

SUMMER 2017

A LEVEL (NEW)
BIOLOGY - COMPONENT 1
A400U10-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

COMPONENT 1 – Energy for Life

SUMMER 2017 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement. Award the middle mark in the level if most of the content statements are given and the communication statement is partially met. Award the lower mark if only the content statements are matched.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			(A species that is seriously) at risk of extinction	1			1		
	(b)			**Any 2 (x1)from:** • {restores/ increases/ improves} biodiversity/ increases (fresh)water habitats (by pond formation)/ increases shrub growth/insect life (1) • Reduces flooding/ reduces damage to habitats/ slows water flow/ filters sediment from water (1) • Use of European beavers: maintains correct genetics of population/ well adapted to environment/ take up correct niche (1)		2		2		
	(c)			**Any 2 (x1) from:** • Introduction of {disease/TB} (1) • {Destruction/ loss} of {land/ habitat} due to {flooding/ bogs/ reduced flow of rivers (below the dams)/ deforestation} (1) • The wrong species would not be so well adapted/ inappropriate habitat for beavers (1)		2		2		
	(d)			• Habitat: The receiving habitat is suitable or example/ effect of beaver introduction on {habitat/ biodiversity} (1) **Any 1 (x1) from:** • Research: The resources and expertise are available for the establishment/ protection (1) • Consultation: with neighbouring landowners and local stakeholders indicates that the majority of those consulted do not oppose reintroduction/eq (1) • Correct beavers: A suitable disease free donor population of Eurasian beavers is identified/ correct species is re-introduced (1)		2		2		
				Question 1 total	**1**	**2**	**4**	**7**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		• N needed for {amino acid/protein/nucleotide / chlorophyll/ ATP/ DNA/ RNA/ named base/ nucleic acid} (1) • P needed for {phospholipid/nucleotide / ATP/ DNA/ RNA/ named base/ nucleic acid } (1) Allow 'both nitrogen and phosphorus are required for nucleotide synthesis' = 2 marks both nitrogen and phosphorus are required for nucleotides and amino acids = 1 mark	2			2		
		(ii)		Protein/ cysteine/ methionine/ any named protein/ enzyme	1			1		
	(b)	(i)		• Adding N alone makes biggest increase, further addition of PKS has little further effect on yield (1) • N increase {of 2.12/ 72.6%} addition of NPK increases {by 2.36/ 80.8%}/ addition of NPKS {by 2.88/ 98.6%}/ Further addition of S {increases by 0.52/ 9.8% increase} (1)		2		2		
		(ii)		Only water applied Accept no fertiliser added/ fertiliser with no added macronutrients added			1	1		
	(c)			Any four (x1) from A. Set up separate tubes with {(culture) solution/ soil} containing {additional N, NPK and NPKS/ each fertiliser} (1) B. record the dry mass of the seedlings {weekly/ at the end/ named time period}(1) C. Select equal size grass seedlings/ {same number/ type} of seeds (1) D. Named other controlled {variable/ condition} e.g. light/ temperature/ pH (1) E. Set up control tubes with no added {macronutrients/ fertiliser} (1) F. Solutions should be topped up/ watered {when necessary/ regularly} (1)			4	4		4
				Question 2 total	**3**	**2**	**5**	**10**	**0**	**4**

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		Safe operating level for humanity/ a threshold value for a global process that is affected by human activity/ limits that global processes or systems must stay within (1) Above this value, the global process will not be stable / below this value the global process will be stable /exceeding boundary leads to gross global environmental change/ irreversible damage if exceeded (1)	2			2		
	(b)		396.5 – 350 = 46.5 $\frac{46.5}{350}$ x 100 (1) = 13.3 (1) Correct answer = 2 marks-+9 13.29/ 13.286/ 13 = 1 mark		2		2	2	
	(c)		• Deforestation reduces carbon dioxide uptake (1) • {Burning of felled trees/ transport of felled trees/ use of fuels in processing trees} puts carbon dioxide into the atmosphere/ (1) • Decay of waste tree material (1)		3		3		
	(d)		A. In a changing environment, some species' adaptation {became unsuitable/ they were selected against} (1) B. Cannot {adapt/ evolve} in a relatively short period of time/ {Animals cannot move fast enough/ seeds cannot disperse quickly enough} to another habitat where they were suitably adapted/ Correct reference to slow mutation rates(1) C. Increased {human population/ industry/ pollution} is causing environmental change (1)		3		3		

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Question			Marking details	Marks available					
3	(e)		Any 4 (x1) from: A. {Seed / sperm/ gene} banks/ rare breed societies (1) B. Breeding programmes (1) C. Fishing quota/ mesh size/ exclusion zone/ ref to seasons (1) D. Trade restrictions/ legislation/ CITES(1) E. Management {of wild populations/ practices} (1) F. Restrict habitat destruction / pollution / deforestation / other means of habitat destruction (1) G. SSSIs/ National parks/ conservation areas/ education/ ecotourism/ NGOs (1) education/ ecotourism and NGOs must be qualified m	4			4		
			Question 3	**6**	**8**	**0**	**14**	**2**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		A. Water is split to release electrons , protons and oxygen (1) reject reference to enzymes splitting water Accept equation B. ATP synthesis/ ADP + P(i) -→ ATP/ fuel proton pumps (1) C. $NADP^+ + 2e^- + 2H^+ \rightarrow NADPH + H^+$ (Accept $NADPH_2$) / reduction of NADP (1)	3			3		
		(ii)		Line from electron acceptor above photosystem1 to diagonal line	1			1		
	(b)	(i)		Chlorophyll b/c Carotene Xanthophyll **3 correct = 2 marks** **2 correct = 1 mark** **0/1 correct = 0 marks**	2			2		
		(ii)		Thylakoid (membrane) in a chloroplast	1			1		
	(c)	(i)		392.5 seconds		1		1	1	
		(ii)		Oxygen produced from {photosynthesis/ photolysis of water}(1) (O_2 fills the airspaces in the leaf so) the leaf is {less dense/ lighter/ more buoyant} (and so rises) (1)(must be in correct context)		2		2		2
		(iii)		**Any 4 (x1) from:** A. (the darker leaves rise more quickly because they have) more {chloroplasts/chlorophyll/ pigment} (in the palisade mesophyll) (1) B. So more {photons will be trapped/ light (energy) absorbed} /more energy transferred to high energy electrons (1) Ignore more wavelengths C. More light dependent stage/ or description of (1) D. More photolysis of water (1) E. More O_2 production (1)			4	4		4

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		A. Change light wavelength/ or description e.g. using filters/ bulbs (1) B. Record the time taken for discs to rise (1) C. Keep hydrogen carbonate concentration constant/ temperature constant/ light intensity/ height of solution (1) D. same colour leaf/ {area/diameter/ size} discs/ species of plant (1)			4	4		6
		(ii)		{Less time/ faster} to rise at the {blue/ violet/ short/ approx. 350nm} **and** {red / longer/ approx. 650nm} wavelengths (1) {Slower to /More time to/ does not } rise in the {yellow/green/ approx. 500nm} wavelengths (1)		2		2		
				Question 4 total	**7**	**5**	**8**	**20**	**1**	**12**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			(Total) number of living {organisms/ bacteria/ cells} (1) in a known (mass/volume) of {substance/liquid} (1)	2			2		2
	(b)			**Any 2 (x1) from** Large numbers/ large range of numbers (1) which would be difficult to plot (1) Log scale increases by a factor of 10 for each number/or correct description (1)		2		2	2	
	(c)			standard deviation measures the spread of data about the mean/ the smaller the standard deviation the more reliable {the data/ the mean/ results}(1) There is overlap between {standard deviations/vertical bars} on graph (1)		2		2	2	
	(d)			Any four (1) from: A. Both tea extract and ginger extract preserve shrimp paste (1) B. The two substances together are more effective than each one on its own (1) C. Up to 40 days {no preservative needed/ preservative is ineffective} (1) D. From 80 days any of the three treatments are better than none (1) E. To preserve {from 120 days/ for a long time} would require both TE and GE(1)			4	4		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(e)			**Any two (x1) from** Taste tests/that flavour is not affected (1) that there are no allergy/toxins produced (1) Cost effectiveness (1) That contamination is {kept below acceptable levels/ non pathogenic} /compares favourably with standard/chemical preservatives/ further tests beyond 120 days/ to test a range of temperatures/ particular temperatures(1)			2	2		
				Question 5 total	**2**	**4**	**6**	**12**	**4**	**2**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths *	Prac **
6	(a)			From the intermembrane space into the matrix (1) Via (a stalked particle containing) ATP synthase (1)	2			2		
	(b)			Cannot produce enough/lower yield of ATP/ no ATP produced (1) For {flight/muscle contraction/active transport / transmission of nerve impulses/ no protein synthesis/ cell division} (1) NOT overheating/ denaturation of proteins		2		2		
	(c)			**Any 4 (x1) from:** A. Use of fat stores as an energy source causes weight loss (1) reference to muscle/ protein is neutral B. Increased metabolic rate to compensate for ATP underproduction (1) C. Lack of ATP causes tiredness/fatigue (1) D. Heat produced as a by-product so increases body temperature (1) E. More sweat production to lower body temperature (1)		1 1	1 1	4		
	(d)			Overheating/hyperthermia/organ failure			1	1		
				Question 6 total	**2**	**4**	**3**	**9**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**Any 2 (x1) from:** A. Can be certain that the two species do not get mixed up (1) B. Does not rely on visual ID/ difficult to ID from a distance / {DNA/hair} is more accurate to identify grey vs red (1) C. Can be monitored at any time/can collect fur when convenient/ do not need to stay on-site to monitor (1) D. DNA will give {numbers of individuals/size of gene pool/ genetic diversity} / DNA would mean they are not counted twice(1) E. No harm /disturbance to squirrels (1)		2		2		
	(b)			**Any 3 (x1) from:** A. At regular intervals place a quadrat/ description of belt transect (1) B. Count the number of cone <u>cores</u> in each quadrat/ along belt transect C. Visit each transect/ quadrat at regular intervals (around every 2–3 weeks) (1) D. Repeat in different areas (1) Max 2 marks for using block sampling			3	3		3
	(c)	(i)		Total energy consumed = 240 x 25 x 0.18 (1) = **1080 kJ** (1)		2		2	2	
		(ii)		1080/84 x 10 000/250 = **514/514.3 kJ** per day per hectare ecf		2		2	2	
		(iii)		514/550= **0.9/0.935/0.934/0.93/0.94/1** squirrels per hectare ecf		1		1	1	
				Question 7 total	**0**	**7**	**3**	**10**	**5**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Any 2 from: From glycolysis (1) NOT link reaction/ Krebs Oxidation/ dehydrogenation reaction/ action of dehydrogenase (1) conversion of triose phosphate <u>to pyruvate</u> (1)	2			2		
		(ii)		<u>Reduced</u> FAD {passes its electrons to the second proton pump / only uses two proton pumps}(1) Only 2 ATP are produced (per reduced FAD) (1)		2		2		
		(iii)		{More respiration/ more ATP} required for <u>muscle contraction</u>(1) the cells use the mechanism which yields {more ATP/ 3 ATP per reduced NAD} (1)		2		2		
	(b)			Removal of {amino/ amine/ NH_2} group/ deamination/ formation of {keto acids/ammonia} (1) Combining of amino group with carbon dioxide/formation of urea (amino/ amine/ NH_2 group)(1) In the liver (1)	3			3		
				Question 8 total	**5**	**4**	**0**	**9**	**0**	**0**

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<table>
<tr><th rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>9</td><td>Indicative content
<table>
<tr><th>Calvin cycle</th><th>Krebs cycle</th></tr>
<tr><td>in chloroplasts</td><td>in mitochondria</td></tr>
<tr><td>in photosynthesis</td><td>in respiration</td></tr>
<tr><td>forms the three C sugar TP/eq</td><td>mitochondria break down a 2 C compound/acetyl group</td></tr>
<tr><td>fixes/eq carbon dioxide</td><td>produces carbon dioxide</td></tr>
<tr><td>reduces GP to TP using reduced NADP</td><td>produces reduced NAD</td></tr>
<tr><td>uses ATP</td><td>produces (a small quantity of) ATP directly.</td></tr>
<tr><td>uses the enzyme Rubisco</td><td>uses dehydrogenase and decarboxylase enzymes</td></tr>
</table>
Compartmentalisation
• Reference to reactions occurring in small volume/isolation of enzymes/reactants.
• Keeping products separate from cytoplasm by use of membranes to isolate reactions within organelles.
• Can use mitochondria close to areas needing ATP/movement of organelles within cytoplasm.</td><td>4</td><td>5</td><td>0</td><td>0</td><td></td><td></td></tr>
</table>

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Detailed explanation of Calvin cycle **and** Detailed explanation of Krebs cycle **and** Detailed explanation of compartmentalisation and comparison *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Any two from Explanation of Calvin cycle Explanation of Krebs cycle Explanation of compartmentalisation *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.*						

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	1-3 marks Brief explanation of Calvin cycle **or** Brief explanation of Krebs cycle **or** Brief explanation of compartmentalisation *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
	Question 9 total	**4**	**5**	**0**	**9**	**0**	**0**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**1**	**6**	**0**	**7**	**0**	**0**
2	**3**	**2**	**5**	**10**	**0**	**4**
3	**6**	**8**	**0**	**14**	**2**	**0**
4	**7**	**5**	**8**	**20**	**1**	**12**
5	**2**	**4**	**6**	**12**	**4**	**2**
6	**2**	**4**	**3**	**9**	**0**	**0**
7	**0**	**7**	**3**	**10**	**5**	**3**
8	**5**	**4**	**0**	**9**	**0**	**0**
9	**4**	**5**	**0**	**9**	**0**	**0**
TOTAL	**30**	**45**	**25**	**100**	**12**	**21**

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