GCE A LEVEL MARKING SCHEME

SUMMER 2017

A LEVEL (NEW)
BIOLOGY – COMPONENT 3
A400U30-1

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 3 – Requirements 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

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			**Any 3 (x1) from:** thin + to reduce diffusion distance/ permeable + allows gas to pass through (1) moist + for gases to dissolve (1) {rich blood supply/ extensive blood capillary network} + maintain diffusion / concentration gradient (1) {large number/folded} + to increase surface area (1) **If give three adaptations/ explanations + 1 or 2 linked = 2 marks** **If three adaptations or explanations given but not linked = 1 mark**	3			3		
	(b)	(i)		the greater the mass the greater the metabolic rate/ directly proportional/ positive correlation	1			1		
		(ii)		Any two (x1) from : body temperature not dependent on that of environment (1) energy needed to generate heat (to maintain body temperature) (1) provide optimum temperature for enzymes/so reaction rate higher (1)		2		2		
	(c)	(i)		to {reduce/ control/ limit} water loss NOT prevent		1		1		
		(ii)		to provide a {reservoir/ store} of {air/ oxygen} (when spiracles are closed) / to aid in ventilation of the tracheal system		1		1		
		(iii)		maintain concentration gradient/ so that {stale air / air with high carbon dioxide conc.} is replaced with {fresh / oxygen rich air}	1			1		
	(d)	(i)		alternate monosaccharides rotated by 180^{o} / {β glycosidic bonds/ β glucose (forms glycosidic bonds)} (1) {bonding / cross-linking} between {molecules/chains} / formation of microfibrils(1) Ignore hydrogen {provides strength / is tough/ prevents collapsing} (of tracheae)(1)	1 1	1		3		
		(ii)		mitochondrion / mitochondria (1) for {aerobic respiration/ ATP synthesis} / require oxygen for respiration(1) tracheole is site of gas exchange / O_2 {diffuses/ passes} from tracheole into (muscle) cells (1)	1 1	1		3		
				Question 1 total	**9**	**6**	**0**	**15**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		coat surface of leaf with clear nail varnish (several times)/ PVA/ sellotape/ Any valid alternative method (1) examine using a (light) microscope (1) count number of stomata in {the field of view / known area} (1)	3			3		3
		(ii)		**Any 2 (x1) from:** • concentration of {O_2 / CO_2 } • humidity • wind speed/ air movement • concentrations of different minerals in soil NOT nutrients • water availability • pH(of soil) NOT temperature/ light		2		2		2
	(b)	(i)		answers to 3 sig fig = 1.14 = 3 marks calculate sd = 1.1419..... = 2 marks Calculate sum differences ^{2} = 13.04 = 1 mark		3		3	3	
		(ii)		• standard deviation shows {variation from mean / reliability of mean}(1) • {high light intensity/ 100W}, lower surface {least reliable/ less reliable} (1) • {low light intensity/ 20W}, upper surface {most/more} reliable/ 100W upper and 20W upper and lower are reliable/ 100W results are less reliable than those at 20W (1) • Use of data(1)			3	3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		**Any 3 (x1) from:** A. hypothesis incorrect (1) B. mean for lower surfaces very little difference / difference less than 1 sd/ overlap in data (1) C. higher sd for high light intensity + less reliable (1) D. correct reference to data (1)			3	3		
		(iv)		at high light intensity + {the density of stomata on the upper surface / the total number of stomata} increases / light intensity has no effect on density of stomata on lower leaf surface (1)			1	1		
				Question 2 total	**3**	**5**	**7**	**15**	**3**	**5**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		E (1) coronary artery (1)	2			2		1
		(ii)		{oxygen / glucose} does not reach {cardiac/ heart} muscle (1) (Muscle) unable to respire (aerobically)/ less ATP produced (1)		2		2		
	(b)	(i)		B (superior vena cava)		1		1		1
		(ii)		Open (Atrial) diastole/ atrial {systole/ contraction} (1) Accept ventricular diastole Closed ventricular systole (1)	2			2		
		(iii)		**Any 4 (x1) from**: A. pressure increases in jugular due to increase in atrial pressure B. Because no valves between jugular and atrium/ backflow of blood into jugular **Atrial pressure increases due to:** C. Atrial systole/ atrial contraction(1) D. Atria filling with blood (1) E. ventricle contracts closing {tricuspid/ AV} valve(1) F. increased pressure in ventricle pushes back on atrium (1)			4	4		
				Question 3 total	**4**	**3**	**4**	**11**	**0**	**2**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		• add Benedict's and{boil / heat (to a high temperature)} / use {Clinistix/ test stick} (1) • colour change (from blue) to {green / brick red} demonstrates presence of glucose /suitable description of use of colour change chart for Clinistix (1) • colour change {indicates approximate values of glucose in urine only/ is subjective} (1)	2	1		3		3
		(ii)		**Any 4 (x1) from:** A. Na^+ ions actively {transported/ pumped} out of (epithelial) cell (1) B. lowers concentration of Na^+ inside cell (1) C. Na^+ in filtrate at a higher concentration than inside (epithelial) cell (1) D. Na^+ co-transported with glucose into epithelial cell (1) E. Glucose concentration in epithelial cell higher than blood plasma F. Glucose moves out of epithelial cell into blood by facilitated diffusion (1) G. circulation maintains plasma concentration below that in epithelial cells/ maintains concentration gradient (1)	1 1	1 1		4		
	(b)	(i)		use of inhibitor would {reduce level of glucose reabsorbed / reducing cotransport}/ owtte(1) so more glucose would be lost in urine (1)			2	2		
		(ii)		**Any 2 (x1) from:** less glucose available for respiration (1) {other respiratory substrates / fat stored in the body} would be used up (1) less excess glucose present to be stored as fat (1) Less glucose available so stored fat is used up in respiration = 2 marks		2		2		
				Question 4 total	**4**	**5**	**2**	**11**	**0**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**Any three (x1) from :** • {HCl/ H^+} activates {enzyme precursor / chymosin precursor / pepsinogen} (1) • Also provides optimum pH (1) • Chymosin causes coagulation of milk proteins which increases the time taken to pass through stomach (1) • (Pepsinogen activated into) pepsin which {digests/ hydrolyses/ breaks down}{ proteins / peptide bonds} (1)		3		3		
	(b)			**calf**: A. abomasum involved in protein digestion (1) **B.** therefore abomasum is larger (1) **adult**: C. Diet mainly {grass/ cellulose rich} which is difficult to digest (1) D. rumen contains bacteria that can digest cellulose (1) E. diet low in protein / abomasum digests mainly <u>bacterial</u> protein (1) F. therefore rumen is larger (1)	1 1 1	1 1 1		5		
	(c)	(i)		animals are not {killed/ harmed} (to obtain rennet / chymosin)			1	1		
		(ii)		• {extract /use} mRNA (1) • because the introns have already been {removed/ edited} (1) • use reverse transcriptase to synthesise <u>single stranded DNA</u> (1)ignore cDNA • DNA polymerase to synthesise double stranded (c)DNA (1)	2	1		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(iii)		(most mammals have a) body temperature of about 37°C (1) (unmodified *E.coli* included) to act as a control / prove that *E.coli* does not produce protease that can act on milk protein(1) Accept reference to humans		2		2		2
		(iv)	I	0.4 cm^3 = 2 marks If incorrect allow the following for 1 mark 3.142/π x 0.65^2 x 0.3 0.398/ 0.3982485		2		2	2	
			II	3.32 x 10^{-4} / 3.3 x 10^{-4} /3.33 x 10^{-4}/ 3 x 10^{-4} = 3 marks ECF from I x 0.02/24 0.000332 = 2 marks 33.2 x 10^{-3}= 2 marks 0.008g / 24 hours = 2 marks 0.4cm^3 x 0.02g cm^{-3} = 1 mark (substitution) ECF 0.008 = 1 mark (answer to substitution) ECF 8 x 10^{-3}= 1 mark (answer to substitution)ECF		3		3	3	
				Question 5 total	**4**	**14**	**1**	**19**	**5**	**2**

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
6	**Indicative content** **Neurotoxin A** • must block the voltage gated Na^+ channels • Na^+ ions cannot flood into the axon • so depolarisation is small • does not exceed threshold potential • no action potential is generated/ all or nothing • impulse cannot reach muscles • muscles won't contract **Neurotoxin B** • allows an action potential to be generated • delay in depolarisation/ Na^+ cannot flood in as quickly • repolarisation takes too long • blocking the K^+ channels • preventing K^+ from flooding out of the axon • restoring the negative charge inside. • neurone does not / takes too long to return to resting potential • impulse takes too long to / does not reach muscles • delay in generating the next action potential/ next impulse **Neurotoxin C** • does not affect the generation of an action potential so does not affect the axon. • blocking the Ca^{2+} channels • prevents Ca^{2+} from entering the neurone. • neurosecretory vesicles do not fuse with the presynaptic membrane • or release neurotransmitter into the synapse. • preventing synaptic transmission • stopping an impulse reaching a muscle						

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Detailed explanation of modes of action of Neurotoxin **A** Detailed explanation of modes of action of Neurotoxin **B** Detailed explanation of modes of action of Neurotoxin **C** *The candidate constructs an articulate, integrated account, 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 modes of action of Neurotoxin **A** Explanation of modes of action of Neurotoxin **B** Explanation of modes of action of Neurotoxin **C** *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*						

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	1-3 marks Brief explanation of modes of action of Neurotoxin **A** **Or** Brief explanation of modes of action of Neurotoxin **B** **Or** Brief explanation of modes of action of Neurotoxin **C** *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.*						
	Question 6 total		**3**	**6**	**9**		

Option A

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**Both for one mark.** • Mucus traps (bacteria) **and** Cilia moves it NOT microvilli	1			1		
	(b)			• Penicillin {inhibits/stops} the formation of cross linkages (between molecules of peptidoglycan) (1) NOT break cross linkages • {The wall is weakened / when osmotic changes occur} the cells lyse (1) • (Gram negative) cell walls have extra layers of lipopolysaccharide/ lipoprotein (1)		3		3		
	(c)	(i)		**Any two (x1) from:** the temperature (of incubation) (1) the length of time <u>of incubation</u> (1) the thickness of the agar in the plates (1) plating density of bacteria/ uniformity of plating (1) pH/ oxygen levels/ species of bacteria/ nutrient concentration (1)			2	2		2
		(ii)		Largest {size of zone of inhibition / clear zone/ diameter/ radius/ area} (1)		1		1		
		(iii)		A,B,C are bacteriostatic **and** D is bactericidal (1) Accept description of modes of action If bacteriostatic: there will be growth/ If bactericidal: no growth/ dead (1)		1	1	2		
	(d)			**One from why:** Needs host cell {for reproduction/ for metabolic processes}(1) Virus has no organelles/ metabolic pathways of its own (1) Uses cell metabolic pathways for reproduction (1) **One from Effects:** Kills the cell by {cell lysis/ production of toxic substances (1)	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)	(i)		0.35-0.40 **and** 1.5 (1) Ignore decimal places		1		1	1	
		(ii)		**Any three (x1) from:** • clonal selection B cell/ antigenic recognition/ antigenic presentation activating B cells(1) • B cell undergoes clonal expansion / mitosis of B cells/ cloning (1) • Differentiates into plasma cells (1) • that {secrete/ produce} the specific antibody (1)	2	1		3		
		(iii)		null hypothesis = There is no significant difference in the concentration of antibodies in the blood samples before and after vaccination/ any difference in the concentration of antibodies in the blood samples before and after vaccination is due to chance		1		1		
		(iv)		The null hypothesis should be rejected, there is a significant difference in concentration of antibodies (before and after the vaccines)/ only 5% probability that it is due to chance/ ORA		1		1		1
		(v)		1.4-1.6 Accept if subtract original concentration e.g. 1.6 – 0.4 = 1.2			1	1	1	
		(vi)		If **fourfold increase** is **less** than **or equal to** 1.5: = Yes successful If **fourfold increase** is **more** than 1.5: = Not successful (1) Mutation/ Antigen variability / change in nucleic acid base sequence / change in amino acid sequence of (glyco)protein / change in tertiary structure, or in shape of protein / existing antibodies do not match / new ones have to be produced (1)	1		1	2		
				Question 7 total	**6**	**9**	**5**	**20**	**2**	**3**

Option B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		X = Haversian canal (1) O_2 delivery/ CO_2 removal / nutrients/ named nutrients(1) Accept reference to nerves and pain	2			2		1
		(ii)		Organic: 30 Inorganic: 70	1			1		
	(b)			• osteoblast {lays down/ secrete} the matrix/ ossification of bone (1) Accept components of matrix • osteoclasts break bone down (1) • BMD increases with Denosumab/ less fractures with Denosumab (1) • therefore breakdown not taking place /osteoblasts more active than osteoclasts(1)	1	1 1 1		4		
	(c)			Denosumab (1) treatment with denosumab reduced the risk fractures by 55-70 % / treatment with oestrogen only 35 % (1)			2	2	1	1?
	(d)	(i)		Realignment + {Immobilisation with cast or splint) / Surgery with pins or plates }		1		1		
		(ii)		T- Score:= -2.41 Accept -2.4		1		1	1	1?
		(iii)		Osteopenia (1) Fracture Risk: Moderate Risk (1)			2	2		
	(e)	(i)		Wrist is a gliding joint (1) wide range of movement/ moves in more than one plane (1) finger is hinge joint (1) bends and straightens/ movement in one plane(1)	1 1	1 1		4		
		(ii)		Rheumatoid (1) auto-immune disease (1) involving an {inflammatory response/ increased blood supply to the joint/ ORA for osteoarthritis (1)		2	1	3		
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

Option C

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Label 1	1			1		
		(ii)		It is involved in learning/ consolidate memories/ spatial memory/ spatial awareness/ navigation(1) permanent memory storage(1) short term to long term memory = 2 marks	2			2		
		(iii)		**Any 2 for 1 mark from:** age/ health/ driving experience / OWTTE			1	1		1
	(b)	(i)		• Yes(1) • posterior hippocampus - significantly {greater volume/ larger}in taxi drivers / ORA(1) • anterior hippocampus was significantly {smaller/ lower volume} in taxi drivers / ORA(1) • hippocampus body - no significant difference between the two groups (1)		3	1	4		
		(ii)		Positive correlation/ as time increases percentage difference increases(1) neuro plasticity: change in structure of brain / new neurones/ new neural pathways/new (neural) connections/ new synapses/ synaptic pruning (in response to change) (1) ACC ref to strengthening / reinforcing / weakening neural pathways redistribution of neurones from anterior to posterior (1) (1) redistribution of neurones from anterior to posterior (1) (indicates) map / street name memory stored in posterior hippocampus (1)		2	2	4		2
		(iii)		Electroencephalography /EEG (1) portable (whereas as MRI isn't)/ Owtte (1)	1	1		2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		335-25/335 x100 / 25-335/335 x 100 (1) 92.5%/ 93% / -92.5% / -93% (2)		2		2	2	
		(ii)		Operant conditioning (1) hyenas rewarded with food/ learning associated with a {reward/ reinforcement/ food} (1)	2			2		
		(iii)		(In successive trials the hyena would) learn that escaping would have favourable consequences /{learn/ remember} the route/ learn how to escape/ positive reinforcement		1		1		
		(iv)		Increase sample size/ use more or different hyenas/ do more trials/ compare against a control/ group description of control (1) NOT different animals / species of hyena / different puzzle box			1	1	1	
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	Synoptic	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	9	6	0	15	0	0
2	0	3	5	7	15	3	5
3	0	4	3	4	11	0	2
4	7	4	5	2	11	0	3
5	3	4	14	1	19	5	2
6	0	0	3	6	9	0	0
Option A 7	0	6	9	5	20	2	3
Option B 8							
Option C 9							
TOTAL	13	30	45	25	100	10	15