GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
BIOLOGY – COMPONENT 3
A400U30-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE A LEVEL BIOLOGY

COMPONENT 3 – REQUIREMENTS FOR LIFE

SUMMER 2024 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)	(i)		palisade {mesophyll / layer / tissue} (1) spongy {mesophyll / layer / tissue} (1) (lower) epidermis (1) Labelling must be unambiguous More than 3 labels – reduce overall mark by 1		3		3		3
		(ii)	I	Ratio A-C: A-B drawing 2.5 (:1) (1) Accept range 2.4 – 2.7 (:1)		1		1	1	1
			II	17.4 mm (2) Accept range 17– 18 **Award one mark for** (60 or 61 or 62 or ecf I) / 3.5		2		2	2	2
	(b)			**Absorption of light.** **Any two (×1) from:** Large surface area (1) {Transparent / owtte} {cuticle / <u>upper</u> epidermis} (1) <u>palisade</u> mesophyll containing {large / owtte} numbers of chloroplasts (1) reference to {orientation / moving} of {chloroplasts / leaf} / elongated palisade cells (1) **Diffusion gases.** **Any two (×1) from:** Stomata (1) (Large) air {spaces / owtte} / large surface area in spongy mesophyll (1) Thin (leaf) / short diffusion distance (1) reference to moisture on cell surface (1)	2 2			4		
	(c)			Support / rigidity / stability ignore reference to cells /structure alone		1		1		
				Question 1 total	**4**	**7**	**0**	**11**	**3**	**6**

<table>
<tr><th colspan="4" 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>2</td><td>(a)</td><td>(i)</td><td>I</td><td>
<table>
<tr><th>Label</th><th>Enzyme name</th><th>Product</th></tr>
<tr><td>A</td><td>(salivary / pancreatic)
amylase</td><td>Maltose
Ignore disaccharide</td></tr>
<tr><td>B</td><td>pepsin / trypsin
Accept endopeptidase</td><td>{Polypeptides /
dipeptides / peptides}
reject amino acids</td></tr>
<tr><td>C</td><td>maltase</td><td>Glucose
Reject beta glucose</td></tr>
</table>
1 mark per line [3]
</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>II</td><td>Peptide</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>• (proteins in epithelial cell) membrane (1)

• Not continuously broken down/
do not need to be replaced/
are not lost /
can be reused /
more stable / withstand wider range of pH
closer to site of absorption (1)</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>vinegar {inactivates / denatures} enzyme /
or description of change of shape of active site</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
</table>

<table>
<tr><th colspan="4" 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></td><td>(c)</td><td>(i)</td><td></td><td>Any two difference + reasons

<table><tr><th>Difference</th><th>Reason</th></tr><tr><td>no rumen in dogs. (1)</td><td>Less cellulose in diet /
No digestion of cellulose in dogs
Reference to production of cellulase (1)</td></tr><tr><td>Stomach is larger in dog (1)</td><td>Dog has {a lot of / more} protein in diet. (1)</td></tr><tr><td>Small intestine is larger in dog (1)</td><td>Dog has protein and fat in diet. (1)</td></tr><tr><td>Caecum is smaller in dog (1)</td><td>{Less / no} cellulose / owtte (1)</td></tr><tr><td>Colon larger in dogs (1)</td><td>More water reabsorbed / less water needs to be drunk (1)</td></tr></table>
RA for cows.</td><td></td><td>2</td><td>2</td><td>4</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>(New born cow feeds on milk) which has high protein (content) (1)

Protein digested in {abomasum / true stomach} (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>{Increase surface area / cell walls broken down releasing the contents} for {digestion / enzyme action}

Accept reference to urea in saliva providing nitrogen</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any two (x1) from** {Cellulose digestion / bacteria} {after / lower than / past} {small intestine / stomach} (1) {Bacteria / cell contents of plants} are not digested (1) SO, more sources of {nitrogen / named compound / minerals} in faeces / manure (1)			2	2		
				Question 2 total	**2**	**8**	**6**	**16**	**0**	**0**

<table>
<tr><th colspan="4" 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>3</td><td>(a)</td><td>(i)</td><td></td><td>A symplast
B vacuolar
C apoplast

All for 2 marks
2 for 1 mark</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Any three (x1) from
<table><tr><th>A</th><th>B</th></tr><tr><td>(only) cytoplasm / no vacuole</td><td>(cytoplasm and) vacuole (1)</td></tr><tr><td>(only needs to cross cell membrane /
does not cross {vacuolar membrane / tonoplast}</td><td>crosses (cell membrane and) {vacuolar membrane / tonoplast} (1)</td></tr><tr><td>(only) uses plasmodesmata/
does not use cell walls</td><td>uses (plasmodesmata and) cell walls (1)</td></tr><tr><td>Faster movement / less resistance (to movement)</td><td>Slower movement / more resistance (to movement) (1)</td></tr></table></td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>{Forces / moves / diverts} {water / (dissolved) ions} from the apoplast (pathway) (1) Accept blocks apoplast pathway
into the {symplast (pathway) / cell / cytoplasm} (1)</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>A. Trunk diameter decreases (1)
Any four (×1) from:
B. An increase in light (intensity) results in stomata opening / stomata open in {day / sun} (1)
C. (so) the transpiration rate increases / owtte (1)
D. Because of cohesion between water molecules / owtte (1)
E. adhesion of water to walls of the xylem / owtte (1)
F. (Resulting in the) diameter of xylem vessels being reduced (1)</td><td></td><td>2</td><td>3</td><td>5</td><td>2</td><td></td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		**Any three (×1) from:** • species of tree / health of tree (1) • Band {position / height} on tree (1) • {Age / size} of {tree / trunk} (1) • correct named environmental factor(1) • position within the wood (1)			3	3		3
	(c)	(i)		18.5 -19 dm^3 day (3) **If incorrect award two marks for:** 75000/4047 30 000/4047 x 200/80 7.41 x 2.5 **If incorrect award one mark for any of:** 200/80 or 2.5 2.5 x 30000 or 75000 30 000/4047 or 7.41		3		3	3	
		(ii)		As water availability increases to {0.3 / 0.4} the transpiration rate increases / from 0 to {0.3 / 0.4} there is positive correlation (1) From {0.3 / 0.4} to 1 {no correlation / the transpiration rate plateaus / levels off} (1) Award one mark for As water availability increases the {transpiration rate increases / positive correlation} and then {plateaus / levels off}		2		2		1
		(iii)		lower degree scatter / points close together / not much spread / owtte (1) more confidence (1)			2	2		2
				Question 3 total	**6**	**8**	**8**	**22**	**5**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			A = grey matter B = ventral root C = central canal D = dorsal (root) ganglion E = white matter 5 correct = 3 marks 3/4 correct = 2 marks 2 correct for 1 mark	3			3		3
	(b)	(i)		Sensory neurone labelled (1) Motor neurone labelled (1) Correct arrows (1)		2	1	3		
		(ii)		Stimulus and response are in different parts of the body / owtte / reference to distance from chest to leg (1) Connector neurone needs to take the {impulse / owtte} down the spinal cord (1)		1	1	2		
	(c)			$50ms^{-1}$ [2] If incorrect award 1 mark for either 0.3 / 0.006 [1] 0.05 or 0.3 / 6 [1] 5 or 0.5 [1] incorrect conversion		2		2	2	
				Question 4 total	**3**	**5**	**2**	**10**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		speeds up (rate of) reactions / <u>biological</u> catalyst / lowers activation energy / catalyses reactions not enough (1) active site <u>complementary</u> to (specific) substrate / ref to lock and key / Enzyme substrate complexes can form / substrate {fits / binds} into active site (1)	1	1		2		
		(ii)		{Produced in / secreted from} {endocrine (system / glands) / ductless glands} (1) (3D shape to) bind with {specific / owtte} receptors (1)	1	1		2		
	(b)	(i)		(results in a) higher (hydrostatic) <u>pressure</u> in the glomeruli		1		1		
		(ii)		GFR stays constant even though {RBF / arterial blood pressure} is increasing. (1) (Diameter of afferent arterioles decreases / afferent arterioles vasoconstrict) to reduce {blood flow / pressure} into the glomerulus. (1)			2	2		
		(iii)		(Above 180 higher GFR causes) (loss of) more {H_2O from the blood / urine / fluid from the body} (to reduce blood pressure)			1	1		
	(c)			A. ADH increases permeability (to water) {DCT/ collecting duct walls} (1) B. aquaporins inserted into membranes/ owtte(1) C. Water reabsorbed into {tissue fluid / blood/ vasa recta/ capillaries/ medulla}(1) D. Low volumes of concentrated urine produced (1)	4			4		
				Question 5 total	**6**	**3**	**3**	**12**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				Humans. A1 (External) intercostal muscles contract **and** rib cage moves {upwards / outwards} A2 Diaphragm contracts **and** flattens A3 pleural membranes are pulled out A4 Volume thoracic cavity increases **and** pressure decreases A5 causes alveoli to expand / air {pulled / moves} into the lungs A6 description of expiration Fish. B1 Mouth open **and** floor of buccal cavity lowers B2 Increases volume of buccal cavity **and** pressure decreased B3 so water enters (buccal cavity) B4 mouth closed **and** floor of buccal cavity raised B5 water {forced/ moves} over {gills / gill filaments} B6 water leaves through the (open) operculum Tracheal system Advantage. C1 <u>Oxygen</u> {diffuses / passes} directly to {cells / tissues} C2 no (need to produce) respiratory pigment / owtte C3 Spiracles can be closed to reduce water loss. C4 Ref to impermeable tracheole reducing water loss / Hairs in spiracles to trap moisture / owtte Disadvantage. C5 {Rate of diffusion / mass of chitin} limits size and shape of insect	4	5				

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content of this level is detailed content from all three areas. *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** Indicative content of this level is detailed content from two areas. *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.* **1-3 marks** Indicative content of this level is any correct statement from the indicative content. *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 6 total	**4**	**5**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		Vector	1			1		
		(ii)		(Parasite) antigens not on surface of host cells (1) {Avoid detection by / hidden from} {host immune system / macrophages / lymphocytes} / do not trigger an immune response (1)	1	1		2		
		(iii)		Antigenic variation / antigen (shape / structure) would be different (1) Memory cells do not recognise antigen / antibodies not complementary (1) No secondary response / primary response occurs / slower immune response/ ref to making new antibodies (1)	1	2		3		
	(b)	(i)		x 2000 = 2 marks Accept range 1900-2100 If incorrect award 1 mark for: 20000 / 10 a measurement / 10		2		2	2	2
		(ii)		Sporozoites {are free swimming / in the plasma / not within host cells} (1) So will be exposed to the host's immune system / will induce an immune response / owtte (1)		1	1	2		
		(iii)		(antigens produced to) allow immune response but {no risk of malaria / do not harm host / owtte}		1		1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any three (x1) from** • *Plasmodium* has {evolved / adapted} to grow inside host (1) • 37 °C {is body temperature / optimum temperature for sporozoites} (1) • *Plasmodium* {are predominantly anaerobic / grow better at low oxygen concentrations / owtte} (1) **not** obligate anaerobe • Liver cells (have a high metabolic rate and so) would have low oxygen concentration / oxygen is bound to haemoglobin in red blood cells / low oxygen concentration in blood plasma (1)			3	3		
		(v)		**Any two (x1) from** • Memory cells (1) • {More rapid / greater} (secondary) response / rapid clonal expansion / owtte} {on re-infection / secondary exposure to antigen} (1) • Retained long after initial immune response / low level of antibodies always present (1)	2			2		
	(c)	(i)		Only control line visible (1) will not have the same antigen / *P.vivax* antigen different / different antigenic type (1) *P.vivax* antigen {not captured by / complementary to} antibody in test / antibodies used in test are {only complementary to / specific to} *P. falciparum* (1)		1	2	3		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		**Any one (x1) from:** Penicillin disrupts cross-linkage formation in peptidoglycan (1) Malaria parasite is a {protoctist / eukaryote} (1) Plasmodium does not have a cell wall (1) Reject ref to Gram negative bacteria		1		1		
		(v)		**Any two (x1) from** • Memory cells (1) • {More rapid / greater} (secondary) response / rapid clonal expansion / owtte} {on re-infection / secondary exposure to antigen} (1) • Retained long after initial immune response / Low level of antibodies always present (1)	2			2		
	(c)	(i)		Only control line visible (1) will not have the same antigen / *P.vivax* antigen different / different antigenic type (1) *P.vivax* antigen {not captured by / complementary to} antibody in test / antibodies used in test are {only complementary to / specific to} *P. falciparum* (1)		1	2	3		1
		(ii)		**Any one (x1) from:** Penicillin disrupts cross-linkage formation in peptidoglycan (1) Malaria parasite is a {protoctist / eukaryote} (1) Plasmodium does not have a cell wall (1) Reject ref to Gram negative bacteria		1		1		
				Question 7 total	**5**	**9**	**6**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Chondrocyte (1) By diffusion through the matrix (1)	2			2		
		(ii)		Prevents the trachea collapsing / keeps the trachea open/ prevents it closing	1			1		
	(b)	(i)		Compact (bone)		1		1		
		(ii)		Reduces overall {mass/weight} (of the skeleton) (1) So less energy required for movement / owtte / less minerals required to produce bones (1) Or Compressible (1) Shock absorbance (1)			2	2		
		(iii)		75 or 80 or 85 μm = 2 marks If incorrect award 1 mark for 16 or 17 / 200 x 1000		2		2	2	2
		(iv)		{Transport system / contains blood vessels} to deliver {nutrients / glucose / oxygen (to bone cells) / remove CO_2 (from bone cells}	1			1		
	(c)	(i)		Hinge (joint)	1			1		
		(ii)	I	Joint space has narrowed / {femur & tibia / bones} touching / cartilage been lost		1		1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
			II	Age - osteoarthritis is mainly in older patients / ORA (1) low activity levels of patient therefore not due to wear and tear (1) Swollen / warm indicates {inflammation / immune response} (1)		1	1	2		
	(d)	(i)	I	ATP PC (1) Short activity and more energy released than by other systems in first 10 seconds (1)		2		2		
			II	Aerobic (1) {Endurance event / owtte} + {Energy from glycolysis is below aerobic after 60 seconds / getting more energy from aerobic after 60 seconds} (1)		2		2		
		(ii)		Same {energy demand / same respiration / glycogen depleted to the same extent / same glucose demand} (on both athletes over the same period)			1	1		1
		(iii)		**Any two (x1) from** Glycogen {replenished more/doesn't fall as low as normal diet / muscle has more} (Improved performance) {train harder / for longer / improves endurance} (1)			2	2		
				Question 8 total	**5**	**9**	**6**	**20**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Scans taken in different planes / one is viewed from above / below, one from the side OWTTE		1		1		1
		(ii)		Medulla oblongata		1		1		
		(iii)		Control of {involuntary / automatic} functions of the body	1			1		
		(iv)		11.1 µm = 2 marks ignore number of dp Accept range 10-11.1 20 / 1800 x 1000 = 1 mark		2		2	2	2
		(v)		Neuroplasticity	1			1		
	(b)	(i)		As number of neurones in rest of the brain increases the number of neurones in the cerebral cortex increases / positive correlation		1		1		
		(ii)		Cerebral cortex involved in higher brain functions (such as complex social behaviour) (1) Primates have larger number of neurones in the cerebral cortex than other mammals (1) Primates have a higher proportion of neurones in the cerebral cortex compared to the number of neurones in the rest of the brain (than other mammals) (1)		1	2	3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		**Any three (x1) from:** Cortisol binds to glucocorticoid receptors in the hippocampus (1) Inhibiting CRH release (from the hypothalamus) (1) So less ACTH released (from the pituitary gland) (1) Reducing the rate of cortisol release (1) Reference to negative feedback (1)	3			3		
		(ii)		Prevents the person becoming overstressed / owtte.		1		1		
		(iii)		May have suffered trauma during childhood (1) {Increased levels of ACTH in blood / Increased cortisol production} causing them to become over-stressed (1)		2		2		
	(d)	(i)		Colour of male and female (plumage) is different / male has more prominent tail.			1	1		
		(ii)		Females - natural selection + male – sexual selection (1) Females need to be camouflaged to increase chance of survival of young (1) Males need to increase chance of {breeding / passing on of advantageous alleles} (1)			3	3		
				Question 9 total	**5**	**9**	**6**	**20**	**2**	**3**

COMPONENT 3: REQUIREMENTS FOR LIFE

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

QUESTION	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**4**	**7**	**0**	**11**	**3**	**6**
2	**2**	**8**	**6**	**2**	**0**	**0**
3	**6**	**8**	**8**	**22**	**5**	**6**
4	**3**	**5**	**2**	**10**	**2**	**3**
5	**6**	**3**	**3**	**12**	**0**	**0**
6	**4**	**5**	**0**	**9**	**0**	**0**
OPTION	**5**	**9**	**6**	**20**	**2**	**3**
TOTAL	**30**	**45**	**25**	**100**	**12**	**19**