GCE A LEVEL MARKING SCHEME

A LEVEL
BIOLOGY – UNIT 3
1400U30 – 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.

WJEC GCE A LEVEL BIOLOGY

UNIT 3 – ENERGY HOMEOSTASIS AND THE ENVIRONMENT

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
1	(a)		Nitrogen and Sulfur (carbon, hydrogen, oxygen) (1) Nitrogen can be use for [chlorophyll synthesis / component of DNA, RNA or ATP] (1)	2
	(b)		Both manganese and iron are component of chlorophyll (1) Deficient of manganese ion would [stop / reduce the rate of] chlorophyll synthesis (1) A deficiency leads to chlorosis (1)	3
	(c)	(i)	5.33 11.67 17.00 18.67 19.67 22.00 22.00 **All answers must round to 2dp**	1
		(ii)	• labels x axis = concentration of Sach's water culture solution + y axis =dry mass of the germinated seedlings (1) • correct units x= mol dm^{-3}, y = g (1) • at least half the grid used in both directions (1) • bar chart was plotted (1) • plots correct +/- ½ small square (1)	5
		(iii)	**Any 3 (x1) from:** As the concentration increase, dry mass increase (1) Dry mass of the plant increases the most at lower concentration (1) 60 mol dm^{-3} is the optimum concentration, there is no change of dry mass above 60 mol dm^{-3} (1) Sachs' water culture solution contains the mineral ions required for are available for [protein synthesis / chlorophyll synthesis] **reject plant growth** (1) At high solution concentration, nutrient uptake becomes the limiting factor (1)	3

Question			Marking Details	Marks Available
2	(a)	(i)	Biosphere Integrity **and** Climate Change	1
		(ii)	Biosphere Integrity **Any 1 (x1) from:** - Risk of extinction of species (1) - Affect food chain / biodiversity (1) Climate Change **Any 1 (x1) from:** - Increase greenhouse gas concentration in the atmosphere / Infrared radiation get trapped in the atmosphere (1) - Global warming (1) - Climate patterns / extreme weather events becomes stronger (eg: hurricanes and typhoons) (1)	2
	(b)	(i)	Labelled Photoautotrophs next to plant box **Accept label next to light blue arrow** (1) Labelled Saprotrophs next to the Decomposition (light purple) arrow (1)	2
		(ii)	Photoautotrophs **Any 1 (x1) from:** During **photosynthesis** CO_2 is removed from the atmosphere, lowering CO_2 concentration in the atmosphere (1) During **respiration**, photoautotrophs are releasing CO_2 into the air, increasing the CO_2 concentration in atmosphere **Ignore reference to O_2** (1) Saprotrophs **Any 1 (x1) from:** Saprotrophs are decomposers and they will break down dead organic matter and waste products (1) By extracellular digestion (1)	2
	(c)	(i)	Arrows in a food chain indicate the direction of energy transfer	1
		(ii)	2030 = 2 marks If incorrect: **Award 1 mark for** 323 x 2π (1) 2029 / 2000 / 2029.46… (1)	2

Question			Marking Details	Marks Available
2	(d)	(1)	**Any 3 (x1) from:** Washing fruit and vegetables removes pesticide residues or heavy metal ions that may remain on their surfaces. (1) Acetylcholinesterase can act as neurotoxins and prevent the breakdown of substance (1) Therefore, acetylcholinesterase remains in synaptic cleft or bound to receptors for longer (1) This triggers more Na^+-gated channels to be opened / Allow depolarisation to occur (1)	3
		(ii)	Immobilized enzyme is more stable in extreme [environment / pH / temperature] (1) Immobilized enzyme can be used in a wider range of physical conditions (1)	2

Question			Marking Details	Marks Available
3	(a)		Mitochondrion / Mitochondria Krebs Cycle Electron Transport Chain (ETC) ATP Synthetase / ATP Synthase 4 correct - 2 marks 2-3 correct - 1 mark 0-1 correct - 0 mark	2
	(b)		Reduced NAD – 3 Reduced FAD – 1 ATP – 1 Must get all 3 correct to get 1 mark	1
	(c)	i	I. Movement of electron (1) Electrons pass through ETC, energy is released (1)	2
			II. Movement of proton (1) Across mitochondrial matrix through ATP synthase (1)	2
		ii	Terminal electron acceptor // Final electron acceptor (1)	1

Question			Marking Details	Marks Available
4	(a)	(i)	I. [transverse plane / axial plane] II. Aorta **and** Inferior vena cava III. X	1 1 1
	(b)		Album - Album is [7.1mm] so it is too large to pass through the filtration slit Glucose - Glucose is [1.0mm] so it is able to pass through the 6 mm filtration slit Answers must refer to the data provided	2
	(c)	(i)	8.80×10^{-5} mm^2 = 3 marks **If incorrect award 2 marks for** $2\pi(0.002)(70)(1 \times 10^6)$ **If incorrect award 1 mark for** $2\pi(0.001)(70)(1 \times 10^6)$ ← radius was halved	3
		(ii)	Dialysis filter is a [fixed / known number and size of fibres / uniform structure] so its surface area can be measured precisely. **ORA**	1
		(iii)	Increases the rate of filtration	1
	(d)	(i)	Filtration rate would [**decrease**] because thicker basement membrane [impedes the passage of filtrate / makes it less permeable / reducing the movement of water and small solutes across the membrane] Answer must explanation to gain the mark	1
		(ii)	X-gene is gene is located on the X chromosome (1) [Males (XY) have only one X chromosome, so one recessive allele will cause the disorder / Females (XX) would need two recessive alleles to be affected, which is less likely] (1)	2

Question			Marking Details	Marks Available
5	(a)	(i)	Effector: quadriceps muscle Part of CNS: spinal cord	1
		(ii)	A: sensory neuron B: motor neuron	1
		(iii)	Only two neurons are involved (sensory → motor) and it is a short pathway with one synapse. (1) It does not involve the brain (the integration happens in the spinal cord) (1)	2
	(b)	(i)	Depolarisation	1
		(ii)	Needle would move towards 0 mV and then towards +40 mV	1
		(iii)	Sodium ion channels open first, allowing Na^+ ions to diffuse into the neuron, causing depolarisation (1) Potassium ion channels open later, allowing K^+ ions to diffuse out, causing repolarization (1)	2
		(iv)	Pump uses ATP to move 3 Na^+ out and 2 K^+ in (against their concentration gradients) (1) Restores ionic balance / re-establishes negative resting potential inside the neuron (1)	2
	(c)		Fewer Ca^{2+} ions enter the presynaptic terminal because the Ca^{2+} channels are blocked by antibodies. (1) Less ACh is released into the synaptic cleft.(1) Insufficient ACh binds to receptors on the postsynaptic (muscle) membrane. (1) Muscle fibres do not depolarise / do not generate an action potential, so the quadriceps muscle does not contract.(1)	4

Question			Marking Details	Marks Available
6	(a)	(i)	To provide nutrients that allow the bacteria to grow.	1
		(ii)	20 µl of culture medium and 20 µl of antibiotic at a concentration of 64 µg/ml means = 40 µl total volume (1) 40/20 = 0.5 × 64 µg/ml = 32 µg/ml (1)	2
			Serial dilution	1
		(iii)	[Well 12 contains no antibiotic but does contain bacteria and all other components, so it ensures that the bacteria can grow normally without the drug / act as control]	1
			To confirm that any lack of growth in other wells is due to the antibiotic and not due to another factor	1
		(iv)	MIC = 1 µg / ml MIC = 4 µg / ml MIC = 2 µg / ml	1
			1.17 = 1 mark **ECF**	1
		(v)	Bacteria might accumulate on top of each other	1
	(b)	(i)	Antibiotic C Lowest MIC for both E. coli and S. aureus meaning it is effective at the lowest concentration **Must get the correct explanation to get the mark**	1
		(ii)	[Gram-positive bacteria have a much thicker peptidoglycan layer / Gram-negative bacteria contain lipopolysaccharide]	1
			The outer membrane of Gram-negative bacteria can act as a barrier, preventing some antibiotics from entering the cell	1
	(c)	(i)	Cytosine / Thymine	1
		(ii)	X has similar molecular shape and functional groups to trimethoprim / X is likely able to bind to the active site of dihydrofolate reductase (1) It would compete with the enzyme's normal substrate (1) This would reduce enzyme activity (1)	2
		(iii)	Potentially valuable drug sources (1) Maintain biodiversity (1)	2

Question	Marking Details	Marks Available
7	Primary Succession ● Primary succession is the change in structure and species composition of a community over time in an area not previously colonised by a community. ● Succession begins with **pioneer species** such as lichens and mosses. ● Succession proceeds through **seral stages** until a **climax community** forms. ● Primary succession refers to the introduction of plants/ animals into areas that have not previously been colonised Biodiversity increases during successions ● Decomposing organic material developed the soil by decomposition of death organism ● The soil becomes richer in minerals thus enabling larger plants such as shrubs to survive.e ● Complexity of food webs increases ● Size of species increases and biomass ● More resistance to invasion by new species ● Soil thickness and humus increases ● Water and mineral availability increases Conservation ● **Quotas** prevent over-felling and ensure **sustainable yield** of timber. ● **Protected habitat areas** conserve biodiversity by preserving undisturbed forest zones. (SSSI) ● **Seedbank** so that different species of trees can be planted when needed ● **Maintain biodiversity** as each species has a role in the ecosystem ● **Conserve gene pools** keep unrelated individual alive that can be used for breeding ● **Pharmaceutical use** some species can be used as medicine	9

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