Rewarding Learning

**ADVANCED SUBSIDIARY (AS)**
**General Certificate of Education**
**2022**

# Biology

## Assessment Unit AS 2

*assessing*

## Organisms and Biodiversity

**[SBY21]**

**MONDAY 30 MAY, MORNING**

# MARK SCHEME

**General Marking Instructions**

***Introduction***

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides examiners with an indication of the nature and range of candidates' responses likely to be worthy of credit. It also sets out the criteria which they should apply in allocating marks to candidates' responses.

***Assessment objectives***

Below are the assessment objectives for Biology.

Candidates should be able to demonstrate:

**AO1** Knowledge and understanding of scientific ideas, processes, techniques and procedures.

**AO2** Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
- in a theoretical context
- in a practical context
- when handling qualitative data
- when handling quantitative data.

**AO3** Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:
- make judgements and reach conclusions
- develop and refine practical design and procedures.

***Quality of candidates' responses***

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17 or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

***Flexibility in marking***

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

***Positive marking***

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17 or 18-year-old GCE candidate.

***Awarding zero marks***

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

***Marking Calculations***

In marking answers involving calculations, examiners should apply the 'own figure rule' so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

**COVID-19 Context**

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

/ denotes alternative points
; denotes separate points
**comments on mark values are given in bold**
*comments on marking points are given in italics*

AVAILABLE MARKS

## Section A

**1** **(a)** Sewage/slurry/silage effluent/milk/waste products from animals/manure/dead organisms/organic fertiliser; [1]

**(b)** Pollutant has been decomposed/broken down/digested by bacteria/provides nutrients for bacteria;
by aerobic bacteria/bacteria which use oxygen (in respiration) oxygen used up by bacteria/bacteria increase/BOD; [2]

**(c)** Organic pollution involves organic matter, but eutrophication involves nutrient enrichment of waterways by phosphates and nitrates/eutrophication is slower to affect oxygen levels/eutrophication involves an increase in plant matter/algal bloom (before decomposition)/eutrophication is a gradual long term process whereas organic is a sudden incident; [1]

**(d)** Testing the ion content of soil before application of fertiliser/only applying fertiliser during periods of crop growth/not applying fertiliser when rain/wet conditions is forecast/not applying fertiliser on land close to waterways/have adequate storage facilities for slurry/preventative legislation e.g. fines; [1] 5

**2** **(a)**

| |
|---|
| Genus/Genera |
| Family |
| Order |
| |
| Phylum/Phyla |
| |

(4/3 correct 2 marks, 2 correct 1 mark, 1 or fewer correct 0 mark) [2]

**(b)** **(i)** Any **two** from:
- eukaryotic
- membrane bound organelles
- unicellular or multicellular with limited tissue differentiation [2]

**(ii)** *Spirogyra*;
chloroplasts/chlorophyll/green pigment present for photosynthesis; [2]

**(c)** Has a nucleus/membrane-bound organelles; [1] 7

| | | | AVAILABLE MARKS |
|---|---|---|---|
| 3 | **(a)** | The layer of moisture allows gases to dissolve (increasing rate of diffusion); water produced by respiration/surfactant is produced to reduce surface tension/in mammals alveoli are deep inside the body to reduce water loss by evaporation; [2] | |
| | **(b)** **(i)** | Any **two** from:<br>• less $CO_2$ getting to palisade layer<br>• fewer/smaller air spaces present<br>• less space for diffusion of gases<br>• greater diffusion distance (to the palisade layer)<br>• fewer pathways through the mesophyll/more likely airflow will get blocked/harder to get to the palisade layer [2] | |
| | **(ii)** | Line following the shape of current line;<br>and lower from 00–24 hours; [2] | |
| | **(iii)** | Compensation point;<br>carbon dioxide absorbed in photosynthesis is the same as carbon dioxide produced in respiration; [2] | 8 |

AVAILABLE MARKS

**4** **(a)** **(i)** As the total cross-sectional area of blood vessels increases the flow rate decreases (allow converse);
decrease in blood pressure/increase in friction/resistance to blood flow as the cross-sectional area increases/
increase in friction as individual vessels have narrower lumen; [2]

**(ii)** The large number of capillaries/extensively large network of capillaries means there is a greater total cross-sectional area; [1]

**(b)** High blood pressure – (exerts a greater force on the artery wall) damaging the (squamous endothelium) lining/the artery wall/damage to the blood vessel;
Cholesterol – builds up (underneath the endothelium) in the artery wall;
Macrophages – move from the blood into the artery wall/contributes to the accumulation of cholesterol;
Plaque – hardened artheroma (which bulges into the lumen of the artery causing a narrowing and restricted blood flow); [4]

**(c)** **(i)** Elastic tissue and smooth muscle (tissue); [1]

**(ii)** Elastic tissue allows the artery to stretch and recoil (as the blood pulses through it);
smooth muscle provides support and can also constrict or dilate the artery (which regulates blood flow to organs); [2]

**(iii)**

| | | | **$mm^3\ s^{-1}$** |
|---|---|---|---|
| | | | |
| | | | 984 |

[2]

**(d)** **(i)** Angiograph/angiogram; [1]

**(ii)** Atheroma removed/stent fitted/atheroma pushed to sides to widen lumen/angioplasty/OAR; [1]

**(iii)** Blood flow is less than in the normal artery;
there is still some of the atheroma present narrowing the lumen/stent provides some resistance/elasticity lost from the wall due to previous atheroma; [2]

16

| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| **5** | **(a)** | **(i)** | Rare plant species; [1] | |
| | | **(ii)** | Many thousands of tourists travel across to the island/large tourist industry;<br>vehicle access is restricted; [2] | |
| | **(b)** | | Monoculture means reduced food source;<br>OR<br>pesticide use reduces food source/causes bioaccumulation in corncrakes<br>OR<br>grass cutting reduces hiding places/reduces nesting sites/reduces places to breed/increases vulnerability to predators/kills birds in the nest; [1] | |
| | **(c)** | | Any **two** from:<br>• birds have somewhere with tall vegetation to hide/undisturbed by mowing/more places to hide/better cover/less likely to be predated/ protection from predators<br>• source of nest material/places to lay eggs/nest/breed<br>• (predator strips encourage) more species which the corncrake can use as food source [2] | |
| | **(d)** | **(i)** | 40% of 8 = 3.2, 50% of 12 = 6;<br>+ 3.2 = 9.2/9; [2] | |
| | | **(ii)** | Any **two** from:<br>• more competition from previous clutch of chicks/less food/ resources available due to competition<br>• greater number of predators later in the season<br>• later in the season so more killed due to agricultural activities<br>• colder/wetter/less daylight available<br>• plants losing leaves so less camouflage [2] | 10 |

| | | AVAILABLE MARKS |
|---|---|---|
| **6** | **(a)** The evaporation of water from mesophyll and diffusion through stomata; [1] | |
| | **(b)** **(i)** Any **three** from:<br>• environmental effects/increased wind/increased heat increases transpiration rate (compared to normal)<br>• light has the least effect/only affects some species<br>• species were not all affected to the same degree by increased environmental factors (wind/heat/light)<br>• under normal conditions transpiration rate is not the same in all species [3] | |
| | **(ii)** Increased wind increases rate of diffusion out of the leaf as air blows diffusion shells (by description) away from the leaf;<br>maintains a high water potential/diffusion/concentration gradient; [2] | |
| | **(c)** **(i)** Scalariform/reticulate;<br>older/mature tissue (as more lignin has been produced); [2] | |
| | **(ii)** Any **three** from:<br>• water molecules form hydrogen bonds between one another/ cohesion occurs between water molecules<br>• water evaporates from spongy mesophyll<br>• creates a negative pressure/tension in the xylem<br>• adhesion between water and xylem walls/water moves up the xylem by capillarity [3] | |
| | **(d)** **(i)** Sieve plate/open cell wall present/companion cell/cell contents reduced/ pushed against side; [1] | |
| | **(ii)** If respiration is reduced then less ATP/energy released;<br>translocation is an active process/requires ATP/energy; [2] | 14 |
| | **Section A** | **60** |

## Section B

AVAILABLE MARKS

**7 (a) Indicative content**

- haemoglobin consists of four polypeptide chains/2 alpha and 2 beta chains
- (each polypeptide) has a haem group/4 haem groups in total
- conjugated protein/has a prosthetic group
- oxygen binds to haem group (to form oxyhaemoglobin)
- each haem group can combine with one oxygen molecule/each haemoglobin group can carry four oxygen molecules
- the binding of the first oxygen molecule distorts the shape of the haemoglobin/conformational change
- this facilitates the binding of the other oxygen molecules/co-operative loading
- oxygen concentration in the environment is the partial pressure of oxygen/pp$O_2$
- at high pp$O_2$ oxyhaemoglobin is readily formed/oxygen associates with haemoglobin readily/has high affinity for oxygen
- oxygen associates with/is collected by haemoglobin in lungs (must be in terms of high pp$O_2$)
- at low pp$O_2$ oxygen dissociates/is released from the haemoglobin readily/has low affinity
- oxygen dissociates/is released from heamoglobin in tissues (must be in terms of low pp$O_2$)
- loading tension is pp$O_2$ at which haemoglobin is 95% saturated with $O_2$
- unloading tension is pp$O_2$ at which haemoglobin is 50% saturated with $O_2$

| Band | Response | Mark |
|---|---|---|
| 3 | Candidates use the most appropriate specialist terms to describe and explain how the structure of haemoglobin and the partial pressure of oxygen impacts on the transport of oxygen throughout the body. At least **7** points must be made. Spelling, punctuation and grammar and the form and style are of a high standard. | [7]–[9] |
| 2 | Candidates sometimes use appropriate specialist terms to describe and explain how the structure of haemoglobin and the partial pressure of oxygen impacts on the transport of oxygen throughout the body. At least **4** points must be made. Spelling, punctuation and grammar and the form and style are of a good standard. | [4]–[6] |
| 1 | Candidates may only briefly describe and explain how the structure of haemoglobin and the partial pressure of oxygen impacts on the transport of oxygen throughout the body. At least **1** point should be made. Spelling, punctuation and grammar and the form and style are of a basic standard. | [1]–[3] |
| 0 | Response not worthy of credit | [0] |

[9]

**(b) Indicative content**

- $ppCO_2$ increases when respiration is high (so oxygen is released to tissues more readily)
- at high $ppCO_2$ haemoglobin has a reduced affinity for oxygen/oxygen is released more readily
- in high $ppCO_2$ the oxygen dissociation curve moves to the right/Bohr effect
- this will offset anaerobic respiration during times of strenuous exercise
- at high altitude $ppO_2$ is reduced/less $O_2$ is available
- at high altitudes oxygen combines more readily/increased affinity with haemoglobin/dissociation curve moves to the left
- increase in red blood cell number (which allows for more efficient transport of oxygen)
- increased ventilation/increased gas exchange surface/lung volume/ deeper breathing
- greater amounts of myoglobin (which act as a store of oxygen)

| Band | Response | Mark |
|---|---|---|
| 3 | Candidates use the most appropriate specialist terms to describe how Bohr effect and high altitude would affect oxygen transport and what adaptations can be seen at high altitudes. At least **5** points must be made. Spelling, punctuation and grammar and the form and style are of a high standard. | [5]–[6] |
| 2 | Candidates sometimes use appropriate specialist terms to describe how Bohr effect and high altitude would affect oxygen transport and what adaptations can be seen at high altitudes. At least **3** points must be made. Spelling, punctuation and grammar and the form and style are of a good standard. | [3]–[4] |
| 1 | Candidates may only briefly describe how Bohr effect and high altitude would affect oxygen transport and some adaptations can be seen at high altitudes. At least **1** point should be made. Spelling, punctuation and grammar and the form and style are of a basic standard. | [1]–[2] |
| 0 | Response not worthy of credit | [0] |

[6] 6

**Section B** 15

**Total** **75**

AVAILABLE MARKS