# GCE AS MARKING SCHEME

**SUMMER 2023**

**AS**
**BIOLOGY - UNIT 1**
**2400U10-1**

**INTRODUCTION**

This marking scheme was used by WJEC for the 2023 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.

# WJEC GCE AS BIOLOGY

## UNIT 1 – BASIC BIOCHEMISTRY AND CELL ORGANISATION

## SUMMER 2023 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) | | (Primary structure is) the {sequence/ order} of amino acids (1) | 1 | | | 1 | | |
| | | (ii) | | Secondary structure – alpha helices / beta pleated sheet (1) Tertiary structure – (secondary structure) {folded into/ held in} a {globular /3D} {structure/ shape} (1) | | 2 | | 2 | | |
| | | (iii) | | • {Bacteria absorb <u>water</u>/ <u>water</u> enters bacterial cells} by <u>osmosis</u> (1) <br> • {less negative/ higher} {water / solute} potential outside (than inside)/ lower solute concentration outside (than inside)/ reference to water potential gradient into cell(1) Accept ORA <br> • Bacterial cells burst (due to damage to cell wall) (1) | | 3 | | 3 | | |
| | | (iv) | | <u>substrate</u> changes the shape of the <u>active site</u> (as it enters it) / (enzyme/ lysozyme) changes shape to allow <u>substrate</u> to fit into <u>active site</u>/ OWTTE (1) | 1 | | | 1 | | |
| | (b) | (i) | | **Any three (×1) from** <br> A. Decreases away from optimum/ description of shape of full graph/ owtte (1) <br> B. Of pH 5.2 (1) <br> C. (changing pH) changes the {secondary/tertiary} structure/ (changing pH) {changes/ breaks} the bonds that hold the enzyme in shape/ owtte (1) Ignore reference to denaturing <br> D. Disruption of active site prevents substrate binding/ fewer enzyme substrate complexes/ active site is no longer complementary to the substrate (1) | 2 | 1 | | 3 | 1 | |

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | (ii) | I | {3.7/ 3.8} -6.6 | | 1 | | 1 | 1 | |
| | | | II | {It is active/ can work} in a range of {areas/ pHs} {in and out of the body/ around the body}/ owtte (1) Must be in relation to body | | | 1 | 1 | | |
| | | | | **Question 1 total** | **4** | **7** | **1** | **12** | **2** | **0** |

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **2** | (a) | (i) | | B<br>A<br>C<br>All three correct = 2 marks<br>one/ two correct = 1 mark<br>0 correct = 0 marks | | 2 | | 2 | | |
| | | (ii) | | <table><tr><td>Difference</td><td>Mitosis</td><td>Meiosis</td></tr><tr><td>1</td><td>Genetically identical</td><td>genetically different (1)</td></tr><tr><td>2</td><td>6 chromosomes/ chromosome number stays the same/ diploid</td><td>3 chromosomes/ chromosome number halved/ haploid(1)</td></tr></table> | 1<br><br>1 | | | 2 | | |
| | (b) | (i) | | 3 µm minute$^{-1}$ (2)<br>1 mark for<br>45/15 | | 2 | | 2 | 2 | |
| | | (ii) | | (sister) Chromatids {separated/ pulled to poles} as distance (between centromeres) increases (1)<br>{Chromosomes/ chromatids/ centromeres} pulled towards (spindle) poles as distance between them and poles decreases (1) | | | 1<br><br>1 | 2 | | |
| | (c) | (i) | | 760 = 2 marks<br>If incorrect award 1 mark for<br>$\frac{38 \times 1000}{50}$ | | 2 | | 2 | 2 | 2 |

| Question | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | | (ii) |  anaphase  metaphase Both correct for 1 mark | 1 | | | 1 | | 1 |
| | | (iii) | Root tip/ Shoot tip/ meristem/ cambium (1) regions of growth (1) | 2 | | | 2 | | 2 |
| | | | **Question 2 total** | **5** | **6** | **2** | **13** | **4** | **5** |

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| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **3** | (a) | (i) | | A – Oxygen – Diffusion/ simple diffusion<br>B – Glucose - Facilitated diffusion/ active transport<br><br>1 mark for correct substances<br>1 mark for transport mechanisms | 1 | 1 | | 2 | | 2 |
| | | (ii) | | • {Oxygen/ (substance) A} passes through {phospholipid/ bilayer} because it is non-polar (1)<br>• {Line A/ oxygen/ diffusion}: {linear relationship/ positive correlation/ directly proportional} (between concentration gradient and rate of diffusion)/ or description (1)<br>• {Glucose/ (substance) B} uses {channel/ carrier/ intrinsic/ transmembrane} proteins as it is polar (1)<br>• {Line B/ glucose/ facilitated diffusion/ active transport}: the rate is eventually limited by the number of {channel/ carrier/ intrinsic/ cell membrane} proteins (1)<br>Must refer to carrier proteins if use active transport | 2 | 2 | | 4 | | |
| | (b) | (i) | | **Mark points in pairs**<br>• No {DNA/ genes} (1)<br>• to code for haemoglobin (1)<br>OR<br>• No ribosomes (1)<br>• for translation/ protein synthesis. (1)<br>OR<br>• No Golgi {body/ apparatus} (1)<br>• so no post-translational modification (1)<br>OR<br>• No mitochondria (1)<br>• to make ATP for protein synthesis (1) | | | 2 | 2 | | |

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **AO1** | **AO2** | **AO3** | **Total** | **Maths** | **Prac** |
| | | (ii) | | No mitochondria (1)<br>No ATP for Active transport (1) | | | 2 | 2 | | |
| | | | | **Question 3 total** | **3** | **3** | **4** | **10** | **0** | **2** |

| Question | | | | Marking details | Marks Available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **AO1** | **AO2** | **AO3** | **Total** | **Maths** | **Prac** |
| **4** | (a) | (i) | | Glycosidic (bond) (1) | 1 | | | 1 | | |
| | | (ii) | | **Similarity:** <br> both made of alpha glucose/ <br> both have (alpha)1,4 glycosidic bonds (1) <br> **Difference:** <br> Amylose straight chain and amylopectin branched/ <br> amylose coiled and amylopectin branched/ amylopectin branched <br> amylose is not / <br> amylopectin has 1,6 glycosidic bonds amylose does not/ owtte (1) | | 1 <br><br> 1 | | 2 | | |
| | (b) | (i) | | the {(chemical) insertion/ addition} of water to break the bond (1) | 1 | | | 1 | | |
| | | (ii) | | {Starch/ amylopectin/ amylose} is digested to maltose by amylase (1) <br> Maltose is digested to glucose by {maltase/ an enzyme} (1) <br> Isomaltase {debranches/ hydrolyses/ breaks} the amylopectin at the {branch points/ 1-6 glycosidic bonds/ bond Y} (1) | | 2 | 1 | 3 | | |
| | | (iii) | | **Any two (×1) from** <br> More amylopectin present (1) <br> It has more {ends/ sites} {to be digested / for the enzyme act on} (1) <br> It is less tightly packed so easier {to digest/ for enzyme to access} (1) <br> Accept reverse argument for all mark points. | | | 1 <br> 1 | 2 | | |
| | | (iv) | | Iodine solution (1) <br> would stay brown (1) | 1 | 1 | | 2 | | 2 |
| | | | | **Question 4 total** | **3** | **5** | **3** | **11** | **0** | **2** |

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| Question | | | Marking details | Marks Available | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| **5** | (a) | (i) |  or equivalent (1) | 1 | | | 1 | | |
| | | (ii) | T  A<br>G  C<br>**A**  T<br>One mark for both A-T<br>One mark for C-G | | 2 | | 2 | | |
| | | (iii) | I | Guanine    16.7 - 17.7%<br>Cytosine    16.7 - 17.7%<br>Thymine    32.3 – 33.3% | 1 | | 1 | 1 | |
| | | | II | Complementary (base pairing) (1)<br>(For all organisms,) G is very close in {composition/percentage} to C **and** A is close in composition to T (1)<br>Variation from exact match due to {experimental error/ free nucleotides in cell} (1) | 2 | 1 | 3 | | 1 |
| | (b) | | Each strand acts as a template (for a new strand) (1)<br>(Newly synthesised) DNA (molecule) contains one old and new strand (1) | 2 | | | 2 | | |

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| Question | | | | Marking details | Marks Available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | (c) | | | **Any four (×1) from**<br>A. {Triplet code/ 3 bases code} for one amino acid (1)<br>B. Explanation of why a minimum of three bases is needed (1)<br>C. There are {64/ many} combinations of the 4 bases/ (genetic code is) degenerate/ or description of (1)<br>D. Different {base / codon} sequences will give rise to different amino acid sequences (1)<br>E. {DNA sequence/ genes} can be varying lengths (1)<br>F. Different amino acid sequences lead to a wide variety of different {proteins/ polypeptides} / ref to exons or introns (1) | 2 | 2 | | 4 | | |
| | | | | **Question 5 total** | **5** | **7** | **1** | **13** | **1** | **1** |

| Question | | | | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **AO1** | **AO2** | **AO3** | **Total** | **Maths** | **Prac** |
| **6** | (a) | (i) | | 70.2 = 2 marks<br>If incorrect award 1 mark for<br>70.20……<br>70<br>172/245 x 100 | | 2 | | 2 | 2 | |
| | | (ii) | | X axis labelled sucrose concentration/ mol dm$^{-3}$ **and**<br>Y axis labelled % plasmolysed cells (1)<br>Linear scales on X and Y axes, including figure at origin (1)<br>Correct plots (tolerance ±$^1/_2$ small square) (2) | | 1<br>1<br>1<br>1 | | 4 | 4 | 4 |
| | | (iii) | I | -11.7 or  - 11.688   or   -11.69  = 2 marks<br>If incorrect award 1 mark for<br>Calculation of Ψs  -( 0.48 ×24.35)<br>11.7 or   11.688   or  11.69<br><br>Will need to check graph for Ψs at 50% plasmolysis | | 2 | | 2 | 2 | 2 |
| | | | II | At this point pressure potential = 0 (1)<br>incipient plasmolysis (1) | 2 | | | 2 | | 2 |
| | (b) | | | Improve confidence: Repeat (all readings) / take more samples(1)<br>Improve accuracy: (Repeat with) sucrose solutions of concentration {between 0.4 and 0.6 / 0.5 / any value between 0.4 and 0.6 }(1) ecf from (iii) I | | | 1<br><br>1 | 2 | | 2 |
| | | | | **Question 6 total** | **2** | **8** | **2** | **12** | **8** | **10** |

| Question | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|
| | | **AO1** | **AO2** | **AO3** | **Total** | **Maths** | **Prac** |
| **7** | Other nucleic acids involved in protein synthesis: <br><br> <table><tr><td>**Nucleic acid**</td><td>**role**</td><td>**Where it functions**</td></tr><tr><td>DNA</td><td>provides the {genetic code/ template} for production of {all RNAs/ mRNA/ provides the genetic code for sequence of amino acids}</td><td>nucleus</td></tr><tr><td>rRNA</td><td>To form ribosomes/ the site of translation</td><td>cytoplasm/ rough ER</td></tr><tr><td>mRNA</td><td>Produced in transcription and used in translation/ transfers genetic code (from nucleus to ribosomes) / owtte</td><td>cytoplasm/ ribosomes</td></tr><tr><td>tRNA</td><td>delivery of amino acids to the site of protein synthesis</td><td>cytoplasm</td></tr></table> <br> **Section C:** <br> How tRNA activation works: <br> • ATP provides energy for the reaction <br> • Two phosphates are released <br> • Amino acid reacts with ATP to form activated amino acid. Amino acid is transferred to tRNA forming activated {tRNA/ amino acid} | 6 | | 3 | 9 | | |

| Question | Marking details | Marks available | | | | | |
|---|---|---|---|---|---|---|---|
| | | AO1 | AO2 | AO3 | Total | Maths | Prac |
| | **7-9 marks**<br>Indicative content of this level is…<br>Detailed description of role of four types of nucleic acid<br>Identification of location of action of all nucleic acids<br>Detailed description of tRNA activation<br>*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.*<br>**4-6 marks**<br>Indicative content of this level is…<br>Two from:<br>description of role of some types of nucleic acid<br>Identification of location of action of most nucleic acids<br>description of tRNA activation<br>*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.*<br>**1-3 marks**<br>Indicative content of this level is…<br>Any correct statements from<br>description of role of some types of nucleic acid<br>Identification of location of action of most nucleic acids<br>description of tRNA activation<br>*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.*<br>**0 marks**<br>*The candidate does not make any attempt or give a relevant answer worthy of credit.* | | | | | | |
| | **Question 7 total** | 6 | 0 | 3 | 9 | 0 | 0 |

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## UNIT 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION

## SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question | AO1 | AO2 | AO3 | TOTAL MARK | MATHS | PRAC |
|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| 1 | 4 | 7 | 1 | **12** | 2 | 0 |
| 2 | 5 | 6 | 2 | **13** | 4 | 5 |
| 3 | 3 | 3 | 4 | **10** | 0 | 2 |
| 4 | 3 | 5 | 3 | **11** | 0 | 2 |
| 5 | 5 | 7 | 1 | **13** | 1 | 1 |
| 6 | 2 | 8 | 2 | **12** | 8 | 10 |
| 7 | 6 | 0 | 3 | **9** | 0 | 0 |
| **TOTAL** | **28** | **36** | **16** | **80** | **15** | **20** |