ADVANCED
General Certificate of Education
2023

Biology

Assessment Unit A2 3

assessing

Practical Skills in Biology

[ABY31]

THURSDAY 22 JUNE, 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.

/ denotes alternative points

; denotes separate points

comments on mark values are given in bold

comments on marking points are given in italics

1 **(a)** Apply north-west rule (or by description);   [1]

   (b) (20 ÷) 0.04 × 0.1 = 5000 cells;   [2]

   (c) Sample from the same depth/stir before sampling each time;   [1] 4

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

   Total number in the capture sample × Total number in the recapture sample
   _____
   Total marked in recapture;   [1]

   (ii) Any **three** from:
   • no significant population changes through immigration or emigration
   • no significant population changes through births or deaths
   • marking of the animal is not detrimental to it in any way
   • marked animals are equally distributed throughout the population
   • all animals in the population equally likely to be trapped (equally trap happy/shy)   [3]

   (iii) 2135 + 1165 = 3300;
   10 265 × 3300 ÷ 1165;
   29 077;   [3]

   (b) **(i)** Students t-test;   [1]

   (ii) The data is not representative due to the short limited time over which the data was collected/small population;   [1] 9

3 **(a)** **(i)** Guard cell/stoma; [1]

(ii) (Lower) epidermis; [1]

(iii) Prevents air bubbles/light can pass through specimen more evenly; [1]

(iv) High likelihood of tearing the tissue layer/not removing enough of the upper layers/other appropriate response; [1]

(v) Ease of removing the upper layers; [1]

(b) 10 mm = 10 000 µm;
10 000 µm ÷ 50 µm;
×200 magnification; [3]

8

4 **(a)** 3 dilutions; [1]

(b) Any **two** from:
- wash/sterilise hands/wear gloves/sterilise work area
- sterile inoculation loop/spreader used
- in the proximity of a Bunsen burner flame
- holding the inoculum bottle and open lid in one hand/do not place lid on bench
- passing the lid region/neck of the bottle through the flame before closing
- sterilise/dispose of equipment appropriately
- open the Petri dish lid as little distance as required to add bacteria [2]

(c) Any **six** from:
- paper discs are soaked in different concentrations of allicin
- Petri dish was filled with agar (and allowed to set)
- *E. coli* is spread on the agar to produce a consistent bacterial lawn
- the paper discs are placed on the agar
- the Petri dish is incubated overnight at 25 °C
- the Petri dish is incubated upside down/labelled on the base
- measure the diameter of the clear zone [6]

9

5 **(a)** **(i)** **X** – M line;
Y – Sarcomere; [2]

(ii) The distance between the Z-lines is very short/the H-zone is very small/difficult to see/difficult to see the I-band; [1]

(iii) Additional mitochondria have not been coloured/additional mitochondria are in a different plane; [1]

(b) Any **two** from:
No ultrastructure would be visible;
or by example of any **two** from:
- Myofibrils
- Mitochondira
- Z lines/M lines [2]

6

6 (a) (i) **X** – sample well;
Y – anode/positive electrode; [2]

(ii) Buffer solution allows the transmission of the electrical current/allows the transport of DNA across the gel/causes separation of different fragments of DNA; [1]

(b) (i) Band 1 has moved further than band 2;
as the fragments in band 1 are shorter; [2]

(ii) Any **four** from:
- there is one band in A, three in B and two in C
- the band in A has travelled the shortest distance/one of the bands in B has moved furthest/Lane B has a fragment that has travelled less than any in C
- band A has the longest DNA fragments/one band in B has the shortest DNA fragments
- band A has no restriction sites
- there are two restriction sites in B/one in C [4]

(iii) Add a marker/ladder of known DNA band sizes; [1]

<div style="text-align:right">10</div>

7 (a) (i) Set up test tubes containing methylene blue and either yeast + glucose or yeast + sucrose;
add the same concentration of sugar/yeast;
place tubes in temperature-controlled waterbath;
time how long it takes for the methylene blue in each test tube to decolourise;
control: dead/boiled yeast; [5]

(ii) Validity would be reduced;
dehydrogenase activity maybe from photosynthesis as well as respiration/colour of peas may make it difficult to see colour change from blue to colourless; [2]

(b) $1 \div 130$;
0.0077;
7.7×10^{-3}; [3]

(c) (i) Missing data point correctly plotted;
line drawn with short straight lines; [2]

(ii) 30 °C is the optimum temperature for dehydrogenase activity;
dehydrogenase activity falls dramatically either side of the optimum; [2]

<div style="text-align:right">14</div>

	Total	**60**