



Rewarding Learning

ADVANCED
General Certificate of Education
2018

Biology

Assessment Unit A2 2

assessing

Biochemistry, Genetics and Evolutionary Trends

[AB221]

MONDAY 11 JUNE, AFTERNOON

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

/ 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)** 1 – ectoderm; [2]
2 – mesoderm;
- (b) (i)** Platyhelminthes; [1]
- (ii)** Annelida **and** chordata; [1]
- (c)** Coelom; [2]
ratio of surface area to metabolically active tissue is increased/can function as a hydrostatic skeleton/provides room for the development of organs/separates muscles of gut from muscles involved in locomotion;
- 2 (a) (i)** Cytoplasm; [1]
- (ii)** Only a short part of the normal aerobic pathway/does not involve substances having to diffuse into the mitochondrion; [1]
- (iii)** To regenerate NAD to pick up H from glycolysis reactions; [1]
- (b) (i)** Any **two** from: [2]
- aerobic respiration produces more ATP than anaerobic
 - produces 38 ATP for each glucose molecule compared to 2 in anaerobic respiration
 - since aerobic respiration results in complete breakdown of glucose (to CO₂ and H₂O)
 - anaerobic respiration produces toxic waste product
- (ii)** Allows for production of extra ATP (above and beyond that produced in aerobic respiration); [2]
to allow higher levels/rates of muscular contraction/important in predators/prey/other appropriate response;
- (c) (i)** Section shaded between exercise stopped and until rate returns to normal; [1]
- (ii)** Extra oxygen is used to convert lactate to pyruvate/re-synthesize reserves of ATP; [1]
- (d)** Any **two** from: [2]
- plants produce ethanol rather than lactate
 - carbon dioxide is produced in plants
 - ethanol/final product not converted back to pyruvate in plants

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		AVAILABLE MARKS
3	<p>(a) Usually smaller/have smaller ribosomes/no nucleus/no membrane-bound organelles/cell walls made of peptidoglycan/no microtubules/slime capsule present; [1]</p> <p>(b) (i) (Increases genetic variation) transfer of plasmids between bacteria/high mutation rates in plasmids; (decreases genetic variation) absence of sexual reproduction/reproduce by division; [2]</p> <p>(ii) Any three from:</p> <ul style="list-style-type: none"> • overuse of antibiotics leads to antibiotic resistance being a selective advantage • antibiotic-resistance genes can spread easily between bacteria (and between populations) • rapid mutation rates in plasmids which is where the antibiotic-resistance genes are located • bacteria can reproduce rapidly thereby increasing the numbers of antibiotic-resistant bacteria populations [3] <p>(iii) Any two from:</p> <ul style="list-style-type: none"> • microscopic • most bacteria may have a similar morphology • very variable genomes • difficult to carry out breeding investigations • other appropriate response [2] 	8
4	<p>(a) (i) Green light is absorbed least; is reflected from leaves (to give the green colour); [2]</p> <p>(ii) Shows how effective photosynthesis is at different wavelengths; [1]</p> <p>(b) (i) Use a water plant/named water plant/other appropriate apparatus, e.g. oxygen probe in a closed container; use the Audus apparatus to collect the oxygen produced over time in different environmental conditions/other appropriate response; [2]</p> <p>(ii) At higher light intensity more photoactivation so more electrons emitted from photosystems; more ATP and NADPH for the light-independent reaction; [2]</p> <p>(iii) Higher levels of carbon dioxide increase rates of carbon fixation/reaction of carbon dioxide with ribulose biphosphate; to produce glycerate phosphate; increased temperature increases enzyme activity; of rubisco/enzymes of the light-independent reaction/light-independent reaction is enzyme controlled; [4]</p> <p>(c) Stomata closed (as consequence of water stress) so less carbon dioxide uptake; less glucose/carbohydrate/amino acid/protein produced for growth; [2]</p>	13

- 5 (a) (i) Rhizoids; [1]
- (ii) Any **two** from:
- they do not possess a waterproof cuticle
 - or stomata
 - or vascular tissue
- [2]
- (iii) Produce haploid spores;
by meiosis; [2]
- (b) (i) Tabulated t value at $p = 0.05$ and d.f. = 24 is 2.064;
95% confidence limits = $58 \pm 2.064 \times 2.422$;
[consequent to t-value used]
upper limit = 63 and lower limit = 53 **[consequent to value above];** [3]
- (ii) Bar completed and limits added accurately; [1]
- (iii) Higher *Sphagnum* cover in flatter areas/lower *Sphagnum* cover on
mountain side;
more standing water in flatter areas/less standing water on mountain
sides; [2]
- (c) Less competition;
so more light available for photosynthesis;
or
spores (when released) are more likely to be blown longer distances/
more effective dispersal of species;
colonisation of new areas; [2]

AVAILABLE
MARKS

13

6 (a) The segregation of the two alleles of one gene is independent of the segregation of alleles of the second gene during gamete formation; [1]

(b) (i) bbDD and bbDd;
BBdd and Bbdd; [2]

(ii) BbDd × Bbdd
gametes (BD) (Bd) (bD) (bd) (Bd) (bd);

	BD	Bd	bD	bd
Bd	BBDd	BBdd	BbDd	Bbdd
bd	BbDd	Bbdd	bbDd	bbdd

offspring genotypes BBDd BbDd BBdd Bbdd bbDd bbdd
 (×2) (×2)
 phenotype black black blue blue red fawn;;
 ratio 3 : 3 : 1 : 1 ; [5]

(c) Hh × Hh

gametes (H) (h) (H) (h);

	H	h
H	HH	Hh
h	Hh	hh

HH identified as lethal genotype; [3]

(d) Mating may not be random/breeding populations may not be large/there is artificial (differential) selection; [1]

- 7 (a) (i) Prokaryotes/bacteria; [1]
- (ii) Human insulin is more effective than animal insulin/less risk of transfer of pathogens from livestock/able to meet demand (for high and rapidly increasing number of diabetes patients)/other appropriate response; [1]
- (b) Functional genes/viruses/liposomes may not reach all parts of lungs/may not penetrate cells due to immune response/other appropriate response; [1]
- (c) (i) Tissue types do not match so attacked by T-killer cells/cell-mediated response/other appropriate response; [1]
- (ii) Any **four** from:
- issues over functional DNA gaining entry to cells is bypassed/no need for vectors
 - no issue over expression (as incorporated fully into DNA/chromosomes)
 - treatment long term/no need for reapplication;
 - functional DNA will be in all blood cells (made by stem cells)
 - no risk of infection/allergic response from vector viruses
 - no risk of rejection [4]
- (iii) May affect genome in unexpected ways/harmful mutation will still pass on to offspring/other appropriate response; [1]

Section A

AVAILABLE
MARKS

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Section B

**AVAILABLE
MARKS**

- 8 (a)** Any **twelve** from:
- DNA carries the code for protein synthesis in its base sequence
 - DNA helicase separates the two DNA strands
 - messenger RNA is made from DNA by transcription in the nucleus
 - bases in mRNA are complementary to the coding strand
 - catalysed by RNA polymerase
 - introns are removed from mRNA
 - mRNA moves to ribosomes in the cytoplasm via nuclear pores
 - both units of a ribosome link together to form functioning ribosome at the first three bases (at one end of the mRNA)/ribosome consists of large and small subunits/ribosomal RNA and protein
 - each set of three bases/base triplet
 - is known as a codon
 - codes for an amino acid
 - transfer RNA has three bases (anticodon) complementary to codon
 - each tRNA brings specific amino acid to correct position on mRNA
 - due to the nature of complementary pairing between codon and anticodon
 - this occurs at the aminoacyl (A) site of ribosome
 - ribosome moves along three bases/one codon
 - a second (peptidyl (P)) site is where adjacent amino acids are linked together by condensation/peptide bonds to form a polypeptide/protein
- [12]
- (b)** Any **four** from:
- substitution is replacement of one base with another
 - if first or second base affected a different amino acid will result
 - and this will be only change in protein
 - change may affect bonding/tertiary structure of protein
 - mutation may disrupt 'start' or 'stop' codons thus producing significant change in protein
 - may have no effect if third base is affected
 - degenerate nature of code (or by explanation)
- [4]

Quality of written communication

[2] marks

The candidate expresses ideas clearly and fluently through well-linked sentences, which present relationships and not merely list features. Points are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.

[1] mark

The candidate expresses ideas clearly, if not always fluently. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.

[0] marks

The candidate produces an account that is of doubtful relevance or obscurely presented with little evidence of linking ideas. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the account.

[2]

Section B

Total

18

18

90