



Rewarding Learning

ADVANCED
General Certificate of Education
2025

Life and Health Sciences

Assessment Unit A2 5

assessing

Genetics, Stem Cell Research and Cloning

[AZ051]

THURSDAY 12 JUNE, MORNING

**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.

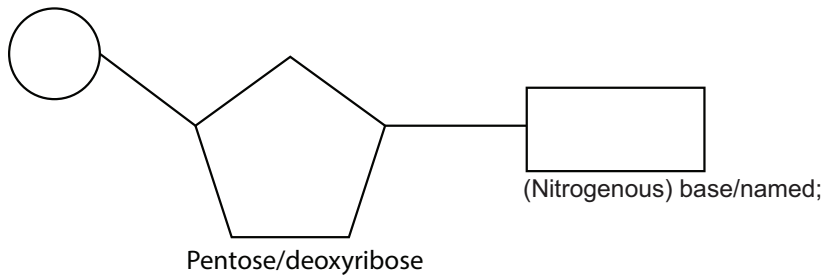
The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends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

- 1 (a) tRNA/transfer RNA; [1]
- (b) (i) A: Anticodon; [1]
- (ii) B: Amino acid binding; [1]
- (iii) C is a region of non-complementary bases/D is a region of complementary bases/single stranded/double stranded; [1]
- (c) Thymine/T [1]

2. (a) Phosphate;



- (b) (i) C = 13.4; G = 13.4;
 $100 - (36.6 \times 2) [1] = 26.8 [1]$
 $\frac{26.8}{2} = 13.4 [1]$ [3]
- (ii) 1. Base equivalence (by description);
 2. Relative proportion/% of each base varies for different species; [2]

- 3 (a) (i) 47; [1]
- (ii) Karyotype contains both X and Y chromosomes; [1]
- (iii) Three copies/trisomy/additional chromosome;
 (chromosome) 21; [2]
- (iv) Presence of an abnormal number of chromosomes in which chromosomes are present in extra copies or are deficient in number; [1]
- (b) (i) When fertilisation occurs;
 chromosome number of the species is maintained; [2]
- (ii) new allele combinations; [1]
- Bivalents assort independently/independent random assortment into gametes; [1]

AVAILABLE MARKS

5

[6]

11

9

			AVAILABLE MARKS	
4	(a)	(i) Location of a gene; on a chromosome;	[2]	7
		(ii) Gene 1: Homozygous; Gene 2: Heterozygous;	[2]	
	(b)	(i) Codominance; Alleles are equally expressed;	[2]	
		(ii) Blood group O individuals must have two recessive alleles;	[1]	
5	(a)	(i) Differentiation; differential gene expression/some genes switched on whilst others are switched off;	[2]	12
		(ii) Stem cells;	[1]	
	(b)	(i) Appropriate line of best fit;	[1]	
		(ii) Any three from: <ul style="list-style-type: none"> • as time progresses those in favour increase • as time progresses those against decrease • both patterns show increases and decreases • those in favour are always higher (converse) 	[3]	
		(iii) Data from 2009 shows a rise of those in favour; [1] and a fall of those against; [1] /36 vs 57 30 vs 62 [2]	[2]	
	(c)	(i) Produce all cell types;	[1]	
		(ii) Advantage 1: ethical/use of embryos avoided; Advantage 2: cells are from patient/less/no chance of tissue rejection;	[2]	

- 6 (a) desired qualities from two organisms are selected; these individuals are bred together; and continued breeding of offspring with selected qualities [3]
- (b) (i) The older varieties of wheat have more extreme values of the characters (by description); modern wheat has intermediate/average for each characteristic; [2]
- (ii) Stem remains upright resulting in less grain loss [2]
- (c) (i) Any **two** from:
- desired change in shorter time
 - selective breeding does not always give best combination
 - genetic engineering allows production of transgenic organisms/ characters from different species to be obtained
 - would not normally be possible naturally
 - guaranteed outcome [2]
- (ii) Any **agreeing pair** from;
- Nutritional enhancement; plants modified to be rich in particular vitamins/minerals;
 - Greater ecological range; drought tolerant plants;
 - Greater productivity (yield); faster/greater/more crops per season/ extra food;
 - Herbicide and pesticide resistance; use herbicide and pesticide without crop damage. [2]

AVAILABLE
MARKS

11

- 7 (a) (i) Blood glucose regulation (by description); [1]
- (ii) $21 + 30 + 33 = 84$;
 84×3 ;
 252 ; [3]
- (iii) Gene contains introns;
these do not code; [2]

(b) **Indicative content:**

rRNA

- this is a major constituent of the ribosome
- providing a platform for translation to occur
- it is made of a large and a small subunit/two subunits
- amino acids are held to allow peptide bonds to form between them
- tRNA moves along it
- location endoplasmic reticulum/cytoplasm

mRNA

- produced from the template DNA strand
- by RNA polymerase
- in the process of transcription
- it is complementary to the DNA
- it is single stranded
- a three base section is called a codon
- moves from nucleus to ribosome. [6]

12

Level of response	Marking criteria	Marks
Excellent	Candidates give five or more points from the indicative content. Presentation, spelling, punctuation and grammar are excellent.	[5]–[6]
Good	Candidates give three to four points from the indicative content. Presentation, spelling, punctuation and grammar are highly competent to make the meaning clear.	[3]–[4]
Basic	Candidates give one to two points from the indicative content. Presentation, spelling, punctuation and grammar are sufficiently competent to make the meaning clear.	[1]–[2]
Response is not worthy of credit.		[0]

AVAILABLE
MARKS

- 8 (a) (i) Deletion/or deletion described [1]
 correct reference to the amino acids [1]
 description of protein being changed/shortened/
 non-functional/different shape [1] [3]
- (ii) Electrophoresis can be used to produce a DNA ladder/separate
 fragments;
 abnormal Dystrophin gene band will be shorter/can move further; [2]
- (b) (i) Females may be heterozygous/carry a copy of each allele/may have D
 and d;
 the dominant allele is expressed in the phenotype; [2]
- (ii) Males have only one allele for Dystrophin
 If they have the mutated gene, then they have the disease [2]
- (c) (i) Parental genotype: $X^D X^d$ x $X^D Y$;
 Gametes: X^D X^d ; X^D Y ; [4]
- (ii)
- | | | |
|---------|-----------|-----------|
| Gametes | X^D | X^d |
| X^D | $X^D X^D$ | $X^D X^d$ |
| Y | $X^D Y$ | $X^d Y$ |
- [2]
- (iii) circle $X^d Y$ in Punnett square [1]
- (iv) Probability: Identify correct genotype;
 0.25/25%/ $\frac{1}{4}$; [1]
- (d) Probability: 0.25/25%/ $\frac{1}{4}$;
 (fertilisation is random and) therefore every pregnancy carries same
 probability; [2]

9 (a) The recessive allele is always shown as a lower case letter; [1]

(b) (i) There is no significant difference between the; observed and expected results; [2]

(ii) $df = 3$; number of (phenotype) classes – 1; [2]

(iii)

Phenotypes	O	E	O-E	(O-E) ²	(O-E) ² / E
Black/normal	4	5.625	-1.625	2.641	0.469
Black/small	1	1.875	-0.875	0.766	0.409
Grey/normal	1	1.875	-0.875	0.766	0.409
Grey/small	4	0.625	3.375	11.391	18.226
					19.513

[4]

(iv) 0.001 and 0.0005; [1]

(v) Reject (null hypothesis) (threshold); Probability values lie to the right of 0.05/right of threshold value [2]

(vi) The genes for body colour A/a and wing-type B/b are linked; [1] on the same chromosome; [1] [2]

Total

AVAILABLE MARKS

14

100