

# MARK SCHEME

# GCSE

## BIOLOGY

## AQA - TRIPLE SCIENCE

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B6 - TEST 5

GENETICS

Advanced

## Mark schemes

- 1.** (a) (i) variation (in population) / mutation 1
- longer nosed individuals get more food / leaves  
*allow longer nosed individuals more likely to survive* 1
- (these) survivors breed (more) 1
- pass on genes / alleles / DNA (for long nose)  
*allow pass on mutation* 1
- (ii) Phiomia / ancestor stretched its nose (during its lifetime) to reach food / leaves 1
- passed on (stretched nose) to offspring  
*allow offspring inherit (stretched nose)*  
*do not allow ref to genes* 1
- (b) (i) insufficient evidence / no proof 1
- ignore other theories, eg religion*  
*do not allow no evidence*
- mechanism of inheritance not known  
*allow genes / DNA not discovered* 1
- (ii) God made all living things / them 1
- allow creationism*  
*ignore religion* 1
- [9]**
- 2.** (a) phosphate 1
- allow  $PO_4^{3-}$*
- do not allow P*
- (b) A / adenine and T / thymine  
**and**  
C / cytosine and G / guanine  
*do not allow U / uracil* 1

(c) (mutation) changes from C to T DNA code  
**or**  
there is a change in the three bases / triplet from CAG to TAG

1

(mutation) changes the amino acid

1

(this could) change the protein

1

(so it) forms a different shape / changed active site  
*accept different tertiary structure*

1

(therefore) the enzyme no longer fits the substrate / carbohydrate

1

(d) mother / woman's gametes correct: A a

1

father / man's gametes correct: a a

1

correct derivation of offspring  
*ecf*

1

identification of child with syndrome H or genotype aa

1

0.5

*ecf*  
*allow 50% / 1 / 2 / 1 in 2 / 1:1*

1

*do not accept 1:2*

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3.

(a)

Classification group	Name
Class	<i>Mammalia</i>
Order	<i>Primates</i>
Family	<i>Lemuroidea</i>
Species	<i>catta</i>

*all 4 correct = 2 marks*  
*2 or 3 correct = 1 mark*  
*0 or 1 correct = 0 marks*

2

(b) Lemur catta  
*ignore capitalisation / non-capitalisation of initial letters*  
*ignore italics / non-italics*  
*ignore underlining / non-underlining* 1

(c) carried by (favourable) currents on masses of vegetation  
*allow description of currents from Figure 2*  
*ignore swimming* 1

(d) isolation of different populations 1

habitat variation between lemur populations  
*allow examples – biotic (e.g. food / predators) or abiotic (e.g. temperature)* 1

genetic variation or mutation (in each population) 1

better adapted survive (reproduce) **and** pass on (favourable) allele(s) to offspring  
*allow natural selection **or** survival of the fittest **and** pass on (favourable) allele(s) to offspring*  
*allow gene(s) / mutation as an alternative to allele(s)* 1

(eventually) cannot produce fertile offspring with other populations  
*allow cannot reproduce 'successfully' with other populations*  
*ignore cannot reproduce unqualified* 1

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**4.** (a) red blood cell 1

(b) 44 1

(c) retina 1

- (d) **7** and **8** / the parents  
do not have **A** (allele)  
or only have **a** (allele) or are **aa**  
*allow converse – if parents had an A (allele) they would have  
Stickler syndrome*

1

so children cannot inherit **A**  
or can only inherit **a**

or

the parents show the recessive characteristic

so must be homozygous  
(recessive)

or must be **aa**  
or parents cannot have **A**

1

- (e) parental genotypes:  
**12 = Aa and 18 = aa**  
or parental gametes:  
**12 = A + a and 18 = a + a**

1

derivation of offspring genotypes  
*allow ecf*

1

identification of **Aa** offspring as Stickler

1

probability =  $0.25 / \frac{1}{4} / 1 \text{ in } 4 / 25\% / 1:3$

*allow ecf – e.g. 0.5 if 12 = AA*

do **not** accept 3:1

do **not** accept 1:4

1

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5.

- (a) any **three** from:

- (gene) cut out
- (gene / cut out) from (bacterial) chromosome / DNA  
*accept (gene / cut out) from (bacterial) plasmid*
- ref to enzymes (at any point)
- (gene spliced) into maize chromosome / DNA
- (gene added) at an early stage of development

3

(b) any **four** from:

- justification based on comparison of the relative merits of at least one advantage and one disadvantage

*max 3 marks if only advantages or disadvantages given*

**Advantages:**

- less effort for farmer **or** less likely to harm farmer  
*ignore ref to cost*
- (pesticide) always there **or** doesn't wash away  
*allow examples eg no need to spray*
- less insects to eat crop / maize **or** carry disease  
*allow pesticide doesn't contaminate water courses*
- so greater crop production / yield

**Disadvantages:**

- (toxin) kills other insects  
*ignore ref to cost*
- so (some) crops don't get pollinated / (sexually) reproduce  
*allow maize not pollinated*
- possible harm when eaten by humans / animals  
*allow may have unpleasant taste*
- damage to food chains  
*allow reduced biodiversity*
- gene may spread to other species

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6.

(a) (i) 3.15 : 1

*accept 3.147:1 **or** 3.1 : 1 **or** 3 : 1*

*do **not** accept 3.14 : 1*

*Ignore 705:224*

1

(ii) any **two** from:

- fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes)
- more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number  
*allow ref. to more representative / reliable*  
*do **not** allow more accurate **or** precise*  
*ignore fair / repeatable*
- anomalies have limited effect / anomalies can be identified  
*accept example of an anomaly*

2

(b) (i) in sequence:

Homozygous  
Homozygous  
Heterozygous

*All 3 correct = 2 marks*

*2 correct = 1 mark*

*1 or 0 correct = 0 marks*

2

(ii) genetic diagram including:

Parental genotypes: **Nn** and **Nn**

*allow other characters / symbols only if clearly defined*

1

**or**

Gametes: **N** and **n** + **N** and **n** derivation of offspring genotypes: **NN** **Nn** **Nn**  
**nn**

*allow genotypes correctly derived from candidate's P gametes*

1

identification: **NN** and **Nn** as purple **and** **nn** as white

*allow correct identification of candidate's offspring genotypes but  
only if some F<sub>2</sub> are purple and some are white*

1

(c) any **two** from:

- did not know about chromosomes / genes / DNA  
**or** did not know chromosomes occurred in pairs  
*ignore genetics*
- had pre-conceived theories  
*eg blending of inherited characters*  
*ignore religious ideas unless qualified*
- Mendel's (mathematical) approach was novel concept  
*allow his work was not understood or no other scientist had similar ideas*
- Mendel was not part of academic establishment  
*allow he was not considered to be a scientist / not well known / he was only a monk*
- work published in obscure journal / work lost for many years
- peas gave unusual results of other species  
*allow he only worked on pea plants*
- Mendel's results were not corroborated until later / 1900

2

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7.

(a) white blood cells have the same DNA / genes / chromosomes

or

have the gene for GH

*allow have all the genes*

*allow all body cells (except RBCs) have all of the genes*

1

(b) enzyme has specifically-shaped active site

1

the 2 antibiotic resistance genes have different (sequence of) bases

1

only Tetracycline-resistance gene fits (active site of) enzyme

or

only Tetracycline-resistance gene is complementary to (active site of) enzyme

1

(c)

Ampicillin	Tetracycline
✓	✗
✗	✗
✓	✓

*1 mark for each correct row*

*if no other mark, allow 1 mark for one correct column*

1

1

1

(d) clone produced by asexual reproduction

*allow by 'mitosis'*

1

all DNA / all genes are copied

*allow GH gene copied*

*allow plasmid copied*

1

every cell receives a copy

or

receives every gene

or

receives GH gene

or

receives plasmid

or

genetically-identical cells

1

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8.

(a) (i) man has (inherited) polydactyly (PD) allele (from mother)

1

man has (inherited) other / normal / recessive allele from father

1

because father does not have PD allele **or** if father had it father would have had PD  
**or** father only has normal allele **or** father is homozygous recessive

1

*allow gene for allele*

(ii) 0.5 /  $\frac{1}{2}$  / 1 in 2 / 1:1 / 50%

*do not allow 1:2 or 50/50*

*allow 50:50*

1

(b) parental phenotypes: both brown

1

parental genotypes: both **Bb**

1

gametes: **B b** and **B b**

1

*allow only on gametes answer line*

*allow ecf from genotypes*

offspring genotypes: **BB (2)Bb bb**

*allow ecf from gametes*

1

offspring phenotypes correctly assigned to genotypes:

**BB & Bb** = brown **bb** = red

*do not penalise confusion of 'phenotypes' & 'genotypes' here*

1

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