

MARK SCHEME

GCSE

BIOLOGY

AQA - COMBINED SCIENCE

B 6 - TEST 6

INHERITANCE, VARIATION AND EVOLUTION

Advanced

Mark schemes

- 1.** (a) cystic fibrosis (allele / gene) recessive
allow an annotated genetic diagram 1
- carrier has only one cystic fibrosis allele / gene
accept carrier is heterozygous
accept any symbol with key or
accept conventional use of symbols
penalise use of chromosome once only 1
- (b) any **one** from:
- Huntington's (allele / gene) dominant
 - (to have Huntington's) need only one Huntington's allele / gene 1
- [3]
- 2.** (a) sexual reproduction 1
- (each embryo produced from) different sperm and egg
or
from different gametes 1
- (so have) different genetic information
allow (so have) different genes / DNA / chromosomes / alleles 1
- (b) any **one** from:
- *idea* that not all individuals would be killed by a change in the environment eg disease
allow species less likely to die out
 - more variation in the population increases chance of survival.
allow idea of restricted gene pool makes species more vulnerable to diseases 1
- [4]

- 3.** *idea*
- banded snails camouflaged/less easily seen
 - fewer banded eaten [by birds]
 - more banded survive to breed
 - more genes for banded passed on
or more banded snails in population
for 1 mark each

N.B.

Accept reverse of all above for plain snails

*All 4 marks may be gained by a relatively short response

[4]

- 4.** (a) (i) e.g. B and b
for 1 mark

1

- (ii) e.g. bb
for 1 mark

1

- (b) no black genes in flock
 all double recessive
for 1 mark each

2

[4]

- 5.** mutation or description of mutation (gives resistance to penicillin)

1

some survive (penicillin)

1

(survivors) reproduce **or** multiply

1

asexual reproduction **or** binary fission **or** cloning
accept mitosis

1

gene for resistance **or** the mutation is passed on (to offspring)
allow reference to bacteria being immune
ignore reference to survival of fittest

1

[5]

- 6.** (a) gene / DNA for poison
allow genetic information for DNA
ignore characteristic

1

is cut from bacterial DNA / chromosome

accept Bacillus thuringiensis / Bt accept plasmid

1

using enzyme(s)

1

and transferred to cotton plant cells / DNA / chromosome

allow genes

ignore plasmid

1

(b) any **two** from:

- gene (for poison) could be passed onto wild plants
allow named insect eg bees
- toxin may kill other / useful insects
- concern about effects on ecosystem / food chain
allow example eg less variation ignore clones
- concern about adverse effects on gene pool of cotton plants
ignore references to humans or quality of cotton
ignore damage soil
ignore diseases

2

[6]

7.

(a) any **two** from

- copies of chromosomes made
- cell divides twice **or** 4 cells formed
- each gamete / cell now has single set of chromosomes
allow chromosome number halved /
cells haploid / cells n

2

(b) any **two** from

- sex cells / gametes fuse / fertilisation
- offspring receive genes or chromosomes or alleles from both parents / DNA
- alleles in a pair may vary

2

(c) (i) new form of gene
allow change in genetic material / DNA / chromosomes / gene

1

(ii) (no)

any **two** from

- some neutral
- exemplified
e.g. extra digit
- some increase chances of survival / reference to natural selection or evolution
- exemplified
e.g. example of disease resistance

2

[7]

8.

(a) alleles in parents

Bb

Bb

alleles in sperms/eggs (*)

B

b

B

b

alleles in children (*)

BB

Bb

bB

bb

hair colour

black

black

black

red

(*) NB ecf

Allow other letters if a clear key

each line correct for 1 mark each

4

(b) evens/50:50/equal/half (e.c.f. from cross below)

for 1 mark

parents

J Smart

M Jones

Bb

bb

children

Bb Bb

bb bb

*(ecf)

black

red

each line correct for 1 mark each

3

J Smart must be BB or Bb
M Jones must be bb or from (a)

Credit cross shown in a matrix:

	<i>B</i>	<i>b</i>
<i>b</i>	<i>Bb</i>	<i>bb</i>
<i>b</i>	<i>Bb</i>	<i>bb</i>

for 2 marks

Bb identified as black hair

bb identified as red hair

or

2 red : 2 black

for 1 mark

1

[8]

9.

(a) (i) gametes i.e. B b and B b

1

correct combination of genotypes i.e. BB, Bb, Bb, bb

1

correct analysis of phenotypes i.e. 3 black fur 1 with brown fur

1

(ii) award one mark for the recognition that it is down to chance (which two gametes fuse) and not simply 'because it's a prediction'

do **not** accept mutation

1

(b) (i) **B** is dominant/ an allele is dominant if it is expressed in the heterozygous phenotype
candidates are likely to use a variety of ways of expressing their ideas

1

b is recessive/ a recessive allele is not expressed in the presence of its contrasting allele

do **not** accept powerful

do **not** accept stronger

1

(ii) alleles are different forms of a gene controlling a characteristic and occupying the same site on homologous chromosomes (e.g. B or b)

1

genes are the units of DNA/sites on chromosomes carrying the information that determines characteristics (e.g. bB)

1

- (c) homozygous: BB / bb / possessing a pair of identical alleles for a character/true breeding

give credit to an explanation using a diagram

1

heterozygous: Bb / carrying a pair of contrasting/different alleles for a characteristic

do not accept references to xx, xy

do not accept gene by itself

1

[10]

10.

- (a) select for breeding;
the plants with the sweetest taste

each for 1 mark

2

- (b) natural population has a wide range of variations;
because it has a large number of alleles;
selective breeding reduces the number of alleles;
cloning perpetuates this reduced number of alleles

each for 1 mark

4

- (c) 3 of:
reference to cuttings;
reference to tissue culture;
reference to hormones;
cloning

each for 1 mark

3

- (d) 4 of:
cut genes for disease resistance;
from chromosomes of 'cooking banana';
introduce into chromosomes of 'ordinary banana';
tissue culture to produce disease resistant plants/clone;
enzymes cut chromosomes

each for 1 mark

4

[13]

11.

- (a) gene for the malarial protein is removed from the malarial pathogen
allow gene for the malarial protein is removed from the malarial protist
- goat DNA / chromosome is cut open
- using an enzyme
- goat and malarial DNA are combined (and put back into the goat cell)
- (b) only females produce milk
allow males don't produce milk
- (c) ensure all the offspring are female (to produce milk)
- ensure all goats will have the malarial protein gene
- or**
- all will produce the malarial protein / vaccine
- (d) any **two** from:
- everyone who drinks milk will get the vaccine
 - no need for storage / refrigeration of the vaccine
 - cheaper production of the vaccine
 - less risk of infection from injections
 - no needles which some people are scared of
- (e) pathogens are engulfed (destroyed) via phagocytosis
- antibodies are produced to kill the pathogens
- (and) antitoxins are made (to stop the symptoms of malaria)

1
1
1
1
1
1
1
1
2
1
1
1

[12]